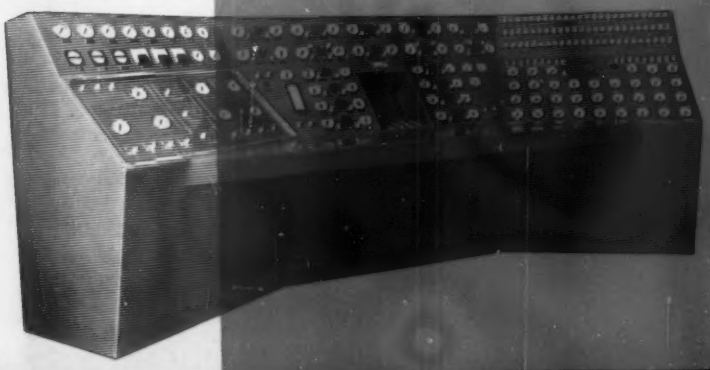
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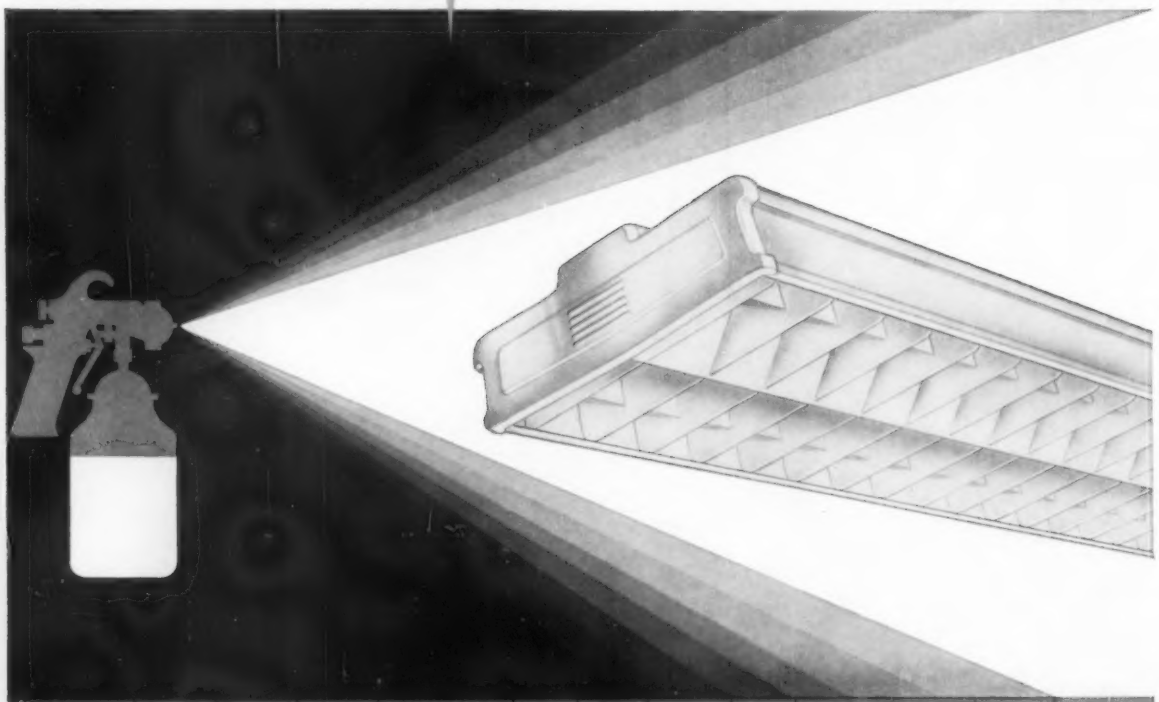
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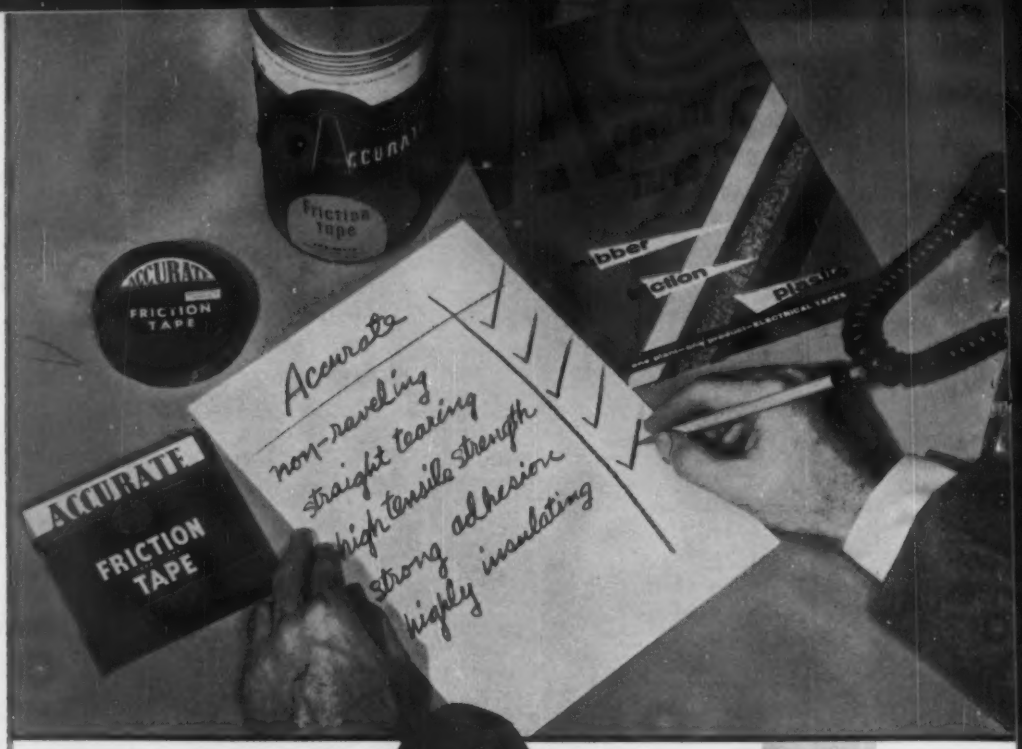
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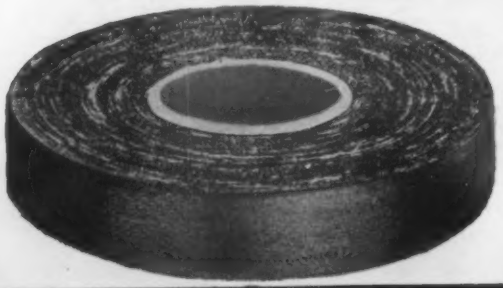


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Washington Report

NOVEMBER • 1959

A strong upturn in business is in the making and will emerge as rapidly as supplies of basic materials will permit. Production being "lost" now as a result of the steel strike will not be a permanent loss—products not being made are merely being postponed. While the gross national product annual rate has steadied at about $480 billion this quarter, same as for the third quarter, a $500 billion (half-trillion-dollar) economy appears in sight for the first quarter following settlement of the strike.

Secondary effects of the steel strike are many, and growing. Some of these effects will linger for some time after the strike is settled, regardless of the rate of recovery of steel production. Here are some of the strike's effects:

- Claims for unemployment compensation are rising rapidly.
- September production dropped to FRB Index of 148, off one point from August, but still 8% higher than a year earlier.
- Need for rebuilding of inventories is growing.
- Steel imports have been growing, are not likely to return to pre-strike level (Europe has over-capacity, Japan is expanding steel making capacity).
- Railroads have been hard-hit—they have lost not only steel shipments, but also haulage of coal that struck mills didn't need.
- Industry modernization and expansion has been slowed, or postponed.
- Machine tool makers' orders have declined for the second consecutive month.
- Auto demand is strong, and growing since new models have been announced, but big question is how many can be built, and how soon.
- Municipalities in which struck steel mills are located face sharp tax loss.
- Time lost (man-days of idleness) is at highest monthly rate on record (13 million man-days in August, 80% attributable to steel strike).

Deadlock in the steel strike has convinced the Administration that the Taft-Hartley Act is inadequate, and is triggering a Congressional drive to find new ways to end strikes. Businessmen look to further automation as a means of weakening the strike weapon.

Building construction declined in September to $5.1 billion, down from a record $5.2 billion the month before. This was the first monthly decline in 8 months, but was still ahead of the $4.7 billion total for September last year. Total value of construction for the first nine months of this year was $41 billion, or 15% higher than the $35.7 billion total for the same period last year.

Private housing starts in September dropped from the August total to 117,000 units. New residential construction dollar volume in September was estimated at $2.1 billion, down $35 million from August. Residential building outlays for the first nine months was estimated at $16.7 billion, up from $12.8 billion last year.

Electric power output continues to run ahead of year-ago totals by about 7% to 10% weekly, notwithstanding the steel strike and curtailed production in auto plants, etc. The bright outlook is for continuing upsurges after the strike is settled, and production begins its steady climb.

Sidelights

School Lighting

What is the impact of the new IES recommended levels of illumination on the practical economics of school lighting systems? John J. Neidhart and Theodore Ake, Jr. of the Miller Co., present a detailed analysis of specific school lighting layouts using a broad range of modern lighting equipment and light sources complete with their relative costs. This study is a valuable source of authentic comparative cost data on the application of modern lighting systems. "School Lighting—Requirements and Economics" begins on page 120.

Electronic Equipment Care

Effective maintenance of electronic equipment in industrial plants requires thorough training of technicians, good tools, precise instruments, up-to-date technical reference material, accurate records, case histories, and planned maintenance routines. Lee Alvey, electrical maintenance foreman at AiResearch Manufacturing Division of Garrett Corporation in Los Angeles, Calif., describes a comprehensive, practical electronic equipment maintenance program in his article "Maintenance of Electronic Equipment" beginning on page 114.

Steel

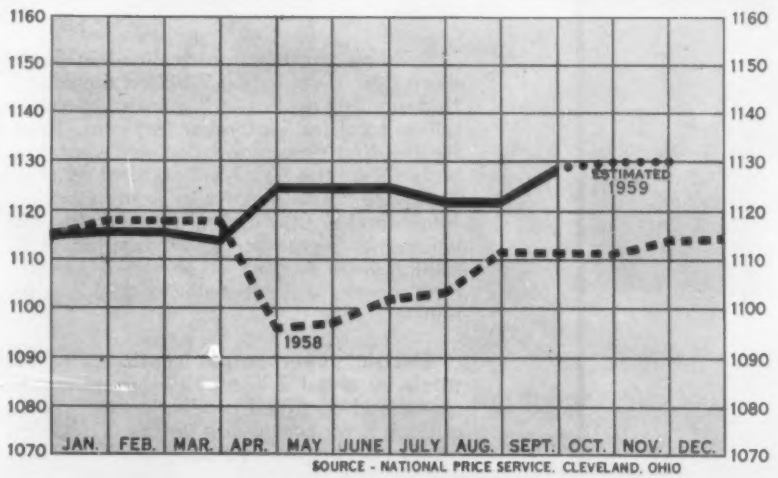
As we go to press, the steel strike is entering the injunction stage with little prospect of an early settlement. Serious local shortages of steel products are beginning to appear as inventories are consumed. Some wholesalers are rationing conduit; others report difficulties in completing orders for all sizes. Even if a settlement is reached soon or an injunction opens the mills, no early improvement can be expected for electrical supplies. Ominous also is the almost certain delay in some construction projects with long waits for structural steel products in prospect. Extreme caution should be observed in taking work with a time limit and penalty clause unless ample supplies are in sight.

Use of Meters

Do your men really know how to use meters? The chances are that many experts will find some surprises in an unusual article in this issue titled "13 Examples Preach Care in the Use of Meters." The author is Samuel Heller, chief engineer of Consolidated Electric Motor Repair Co. of New York, and the data comes from actual job experience in the use of meters pointing up the need for careful application and calling attention to some of the potential dangers to watch for. The article begins on page 140.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



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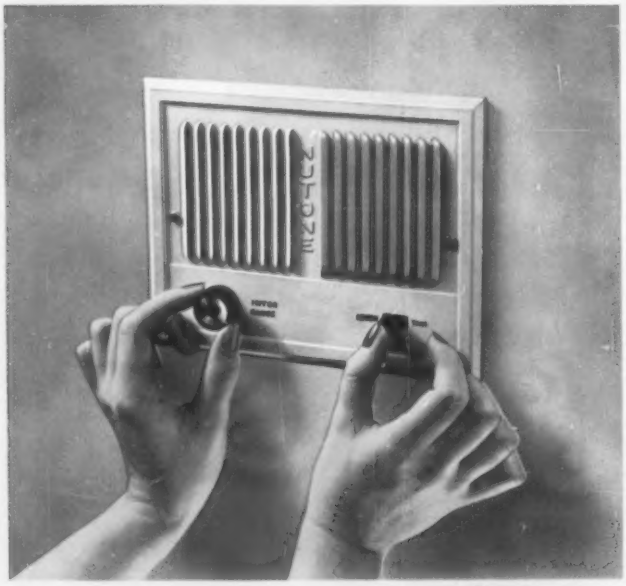
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The business community has made an impressive start in going to the desperately needed financial aid of our colleges and universities. Business contributions to higher education have increased from only $40 million in 1950 to $136 million in 1958.

This rise in financial aid to higher education should be a great source of satisfaction to the business community. But it goes only part way toward meeting the growing needs of colleges and universities for financial help. Over the next ten years business aid to our privately supported colleges and universities alone must increase to at least $500 million a year merely to provide decent faculty salaries and meet the increased operating costs of taking care of enrollments that will almost double.

One pervasive reason why many business firms have not joined the ranks of the companies contributing to higher education seems to be that, in the interest of prestige and public relations, they are making their provision of aid contingent upon finding some particularly novel way of providing it. So long as this point of view persists, business aid will lag, for there are simply not enough ways of providing financial aid that are both notably novel and sensible.*

How The Plan Works

There are, however, some well-tested ways of providing aid which improve rather than fade in appeal with more using. One such way is the making of supplemental tuition payments to colleges and universities at which a company's employees take courses.

Many companies have scholarship or tuition-refund programs which cover all or part of the costs to their *employees* of taking college courses. But, in most colleges and universities, tuition charges fall far short of covering the full cost of the education given. By making an unrestricted "cost-of-education" grant a part of their employee scholarship or tuition-refund plans, these companies could make a material contribution toward covering the *college's* full costs as well.

The tuition supplement can be a fixed amount or a percentage of the tuition charged. Some plans provide for supplements as high as 100% of tuition, though there is usually an upper limit to the total supplemental payment given for each employee enrolled in the institution.

The plan seems to have originated with the Ford Motor Company Fund. When we at McGraw-Hill first learned of it, it appealed to us as having so many advantages, and so few disadvantages, that we adopted it as one part of our own program of financial aid.

---

*The efforts of the McGraw-Hill Publishing Company to find a suitable method of aiding higher education prompted the writing of a "more or less Socratic dialog" entitled *A Business Wrestling with the Problem of Aid to Colleges and Universities.* Copies of this pamphlet, which underlines the difficulty of finding both a novel and satisfactory method of providing aid, are available on request.

HOW THE HEADS OF SOME OF THE INSTITUTIONS TO WHICH McGRAW-HILL HAS MADE GRANTS FEEL ABOUT THE TUITION SUPPLEMENT PLAN

"We are pleased not only because this addition to the never adequate supply of non-earmarked funds is a most welcome one, but also because it attests to the fact that the employees of our neighboring business firms are benefiting from the courses we offer at times convenient for them. We hope this mutually beneficial plan may continue and grow with the years."

Grayson Kirk, President
Columbia University

"I shall take this occasion to express deep sentiments of appreciation, in my own name and in the name of the members of the Board of Trustees, for the very effective manner in which your corporation is aiding higher education by the payments made under your tuition supplement plan. Certainly your action is indicative of the fact that you realize industry and higher education must join forces to preserve the basic American system of free enterprise."

Very Reverend John A. Flynn, C.M.
President, St. John's University

"The growing recognition by business and industry of the financial needs and important services rendered to the community by the colleges and universities is most encouraging, and Temple University is deeply appreciative of the fine support extended through McGraw-Hill's program of supplementary grants."

Robert L. Johnson, President
Temple University

The Plan's Advantages

The main advantages of the tuition supplement plan are:

- **It is simple and easily administered.** Payments can be made when scholarships or tuition refunds are granted, or at another time convenient to the company.
- **It relieves the company of the difficult and sometimes disagreeable task of choosing one college rather than another.** The individual employee makes the choice.
- **It directly serves the interest of the company by encouraging and aiding the institutions where its employees take courses.** In a sense, the company makes contributions in direct proportion to the value it receives in education for its employees.
- **It directly serves the interest of the colleges and universities receiving the grants by getting money to them in the form most appreciated**—unrestricted funds to be used at the discretion of their administrators.

Largely because tuition supplements are unrestricted as to use, this plan enjoys the unqualified approval and gratitude of the schools receiving such aid. This is not true of some of the other plans for granting aid to colleges and universities.

Tuition supplements, of course, can't be regarded as large efforts relative to the need of higher education and the responsibilities of business. But they are a very practical and useful first step, involving almost no problems. If you are not familiar with the idea of supplemental grants, why not discuss it with some of your friends in the field of higher education?

The Price Of Novelty

Our experience with tuition supplements indicates that this is an excellent plan, and we are glad to recommend it to other companies looking for an effective method of providing financial aid to higher education.

At any rate, we hope that business firms will not postpone granting financial aid until they find some novel way of doing it. If they do, it will be another case of too little and too late.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

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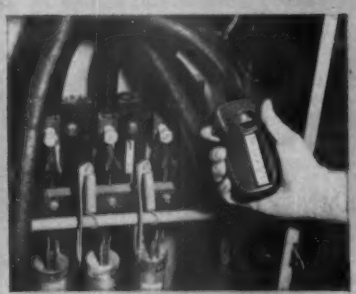
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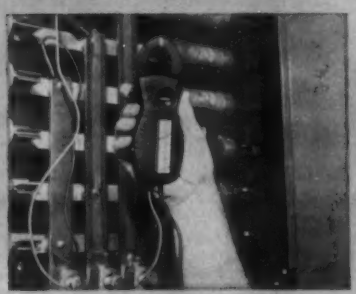
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Check for low-voltage conditions



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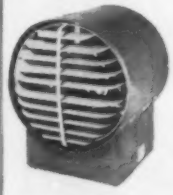




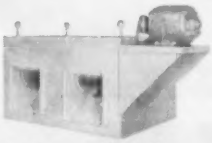
FAR-INFRARED RADIANT HEATERS

For annealing, calendering, curing, drape forming, drying, preheating, embossing, forming and shaping, fusing of cast films and sheets, heat sealing, ink and paint drying, laminating, planishing and polishing, postforming, slush molding, transfer molding, resin curing and finishing, setting paper additives and coating, vacuum forming, vinyl fusing.

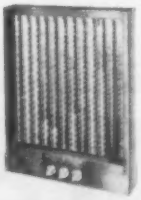




BLOWER TYPE UNIT HEATERS



For larger areas requiring greater amounts of heat distribution . . . such as factories, garages, machine shops, drying rooms. For areas where positive circulation is desired to maintain uniform temperatures . . . such as warehouses, garages and plant offices.



IN-DUCT TYPE HEATERS

For mounting in forced air ducts to supply heated air for ovens, dryers, space heating, process work.



BASEBOARD HEATERS

Perimeter heating for homes, offices, lobbies . . . anywhere the ultimate in comfort heating is desired.

UNIT VENTILATORS

Electric heating and fresh air ventilating for schools, churches, theaters, plant meeting rooms, gymnasiums, lobbies . . . wherever large numbers of people congregate in a restricted area.

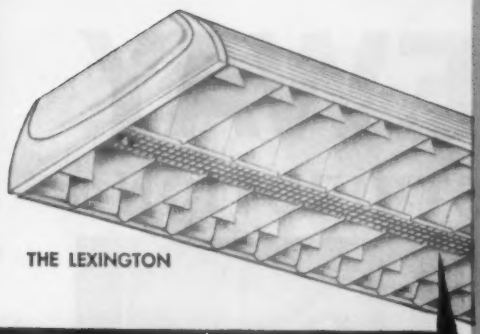


CHROMALOX

Electric Heat

INDUSTRIAL • COMMERCIAL • RESIDENTIAL

EDWIN L. WIEGAND COMPANY
7637 Thomas Boulevard • Pittsburgh 8, Pa.

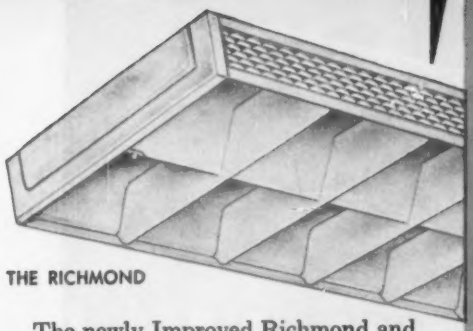


THE LEXINGTON

New Improved

RICHMOND and LEXINGTON

... at New, Low Prices



THE RICHMOND

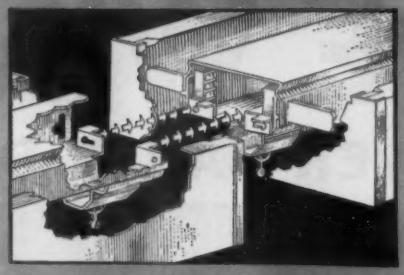
The newly Improved Richmond and Lexington Series by Miller offer outstanding Values for lighting Schools, Offices, and Stores.

Four exclusive *installation and maintenance features* have been built into all units in both series. *Prices for most types are at new lows*, while illumination performance remains high as ever. And, these new fixture groupings have an even trimmer, more modern appearance.

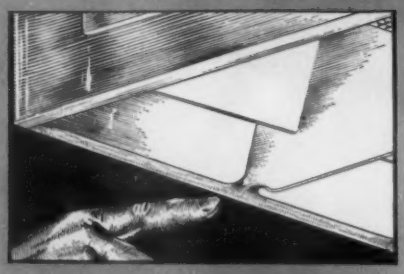
You can choose between 45° x 45° or 35° x 25° shielding for both series; 2 or 4 Lp., 40W Rapid Start or 8 ft. Slimline. 2 Lp. Richmonds and Lexingtons also available for 800 MA High Output lamps. *Power-Groove* operation is a brand new option for the 2 Lp. Richmond.

For complete catalog and price information write Dept. RL-119. For a physical demonstration contact your Miller Representative, or your Miller Distributor.

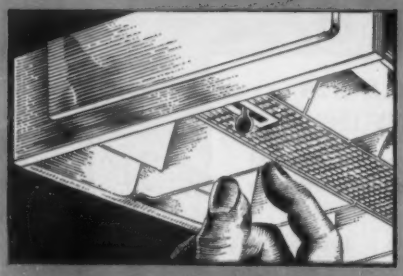
New Exclusive Features



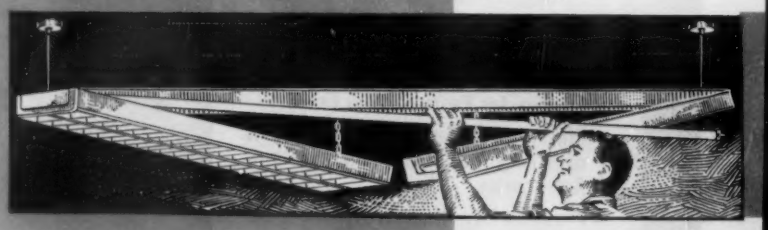
Easy channel connection and accurate horizontal alignment assured by built-in key slot connector and aligning tabs.



Sturdy, one piece cross louver construction assures rigid, rattle free shielding assembly.



Shielding assembly is securely locked in position (or lowered on safety chains) by quarter turn of visual action thumb latches.



Suspended 8 Ft. units can be easily relamped from single ladder position.

THE **miller** COMPANY

MERIDEN, CONNECTICUT

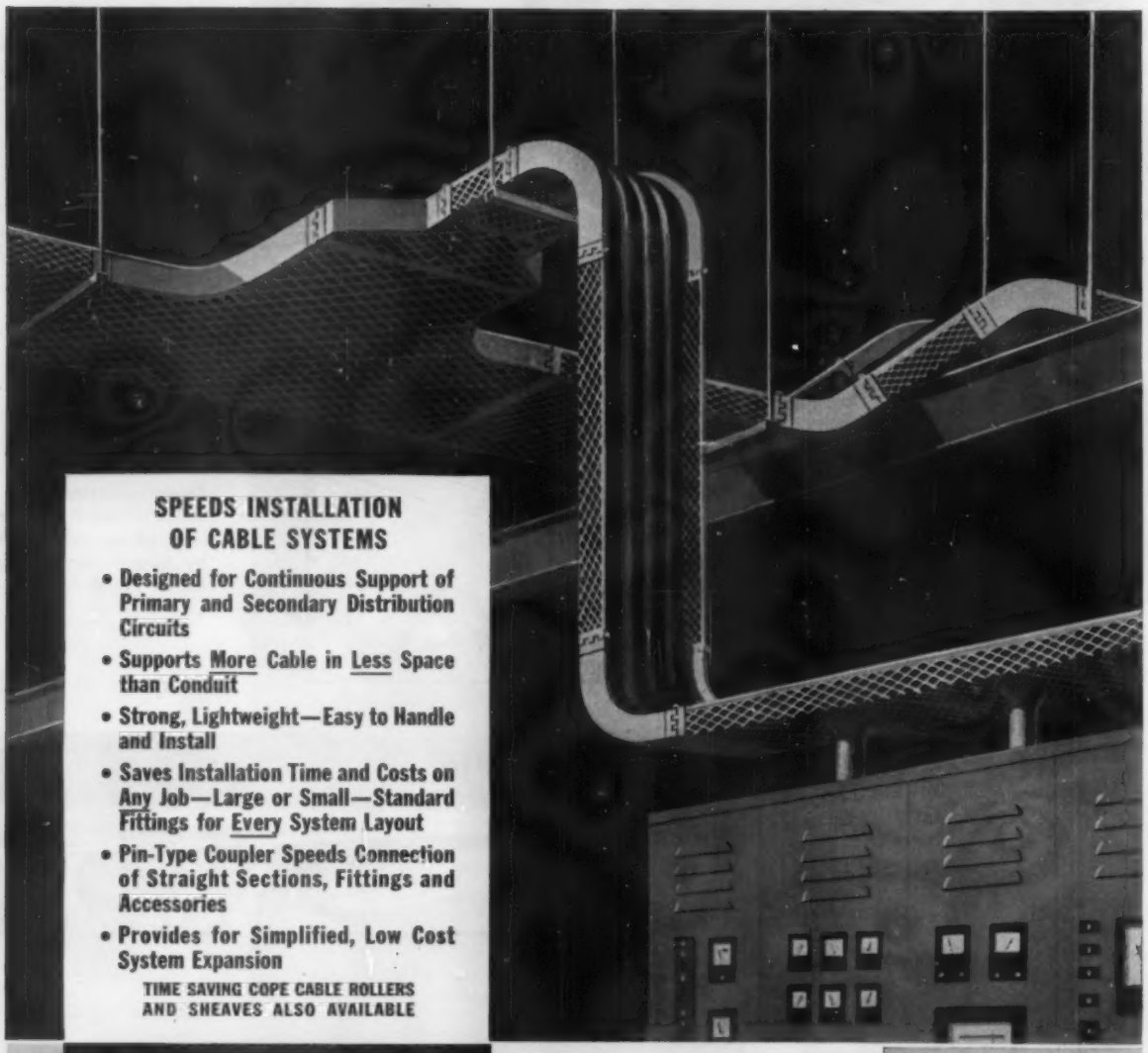
LIGHTING BY

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SINCE 1844

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SPEEDS INSTALLATION OF CABLE SYSTEMS

- Designed for Continuous Support of Primary and Secondary Distribution Circuits
- Supports More Cable in Less Space than Conduit
- Strong, Lightweight—Easy to Handle and Install
- Saves Installation Time and Costs on Any Job—Large or Small—Standard Fittings for Every System Layout
- Pin-Type Coupler Speeds Connection of Straight Sections, Fittings and Accessories
- Provides for Simplified, Low Cost System Expansion

TIME SAVING COPE CABLE ROLLERS AND SHEAVES ALSO AVAILABLE



ASK FOR PROOF! Get time and cost saving details of Cope Wireway from your Authorized Cope Electrical Wholesaler today. For descriptive brochure or engineering assistance for special system requirements, write to T. J. Cope, Division of Rome Cable Corporation, Collegeville, Pennsylvania

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COPE

Originators of First Integrated Line of Cable Supporting Systems

WIREWAY • LADDER • CHANNEL • CONTROLWAY

Division of ROME CABLE CORPORATION

COLLEGEVILLE, PENNSYLVANIA

For Dependability Beyond a Doubt Always Specify P&S



"A quality building for quality tenants*" demands quality wiring devices. That's why the beautiful new Canada House at 680 Fifth Avenue in New York uses P&S 20AC1-I AC switches. A good reason, too, why P&S 5252-I and P&S 7310's are also used.

P&S 20AC1 heavy duty AC switches are designed with extra-heavy silver alloy contacts mounted vertically at the *nodal point* (point of least vibration) to avoid excessive vibration and eliminate arcing and poor contact. P&S super AC switches can be used at full rated capacity for tungsten filament lamp loads and fluorescent installations.

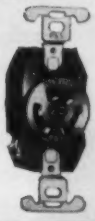
*Slogan for the new Canada House

20AC 1 Ivory

5252-I



7310



For information on these and other P&S wiring devices write Dept. ECM-1159.

P&S®

PASS & SEYMOUR, INC.

SYRACUSE 9, NEW YORK

60 E. 42nd St., New York 17, N. Y. 1440 N. Pulaski Rd., Chicago 51, Ill. In Canada: Renfrew Electric Co., Ltd., Toronto, Ontario



One of these 4 types will meet your requirements . . . *best*

- Is minimum motor current inrush your primary consideration?
- Is it reduced starting torque? • Or maximum smoothness in acceleration?
- Is cost an important factor?

With these four types Square D can meet any reduced voltage starter requirement—exactly.

***Write** for Reduced Voltage Starter Bulletins. They give complete details.*
Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

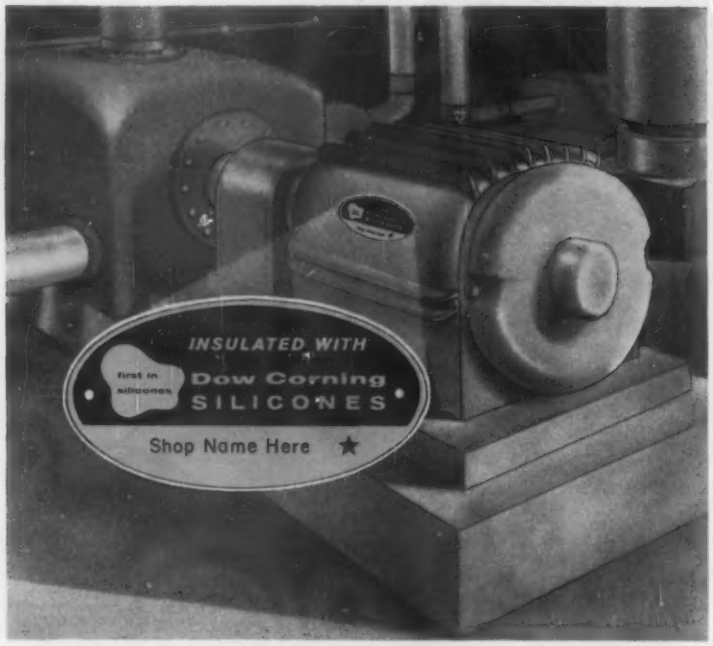
NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

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BELL
NEW! Saf-T-Lok® CONSTRUCTION
Snaps Open! Stays Open! Snaps Shut!
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SILICONE NEWS from Dow Corning

Better Than New...Cost Less Too



Silicone Rewinds Provide Extra HP to Handle Increased Loads . . . Overloads

From coast-to-coast, from Canada to the Gulf, nearly 200 Service Shops are now qualified and equipped to rebuild motors from your plant so that they will deliver from 25% to 50% greater horsepower than they did as originally supplied.

Service Shops identify these motors by affixing brass plates that read "Insulated with Dow Corning Silicones" . . . and bear the shop name.

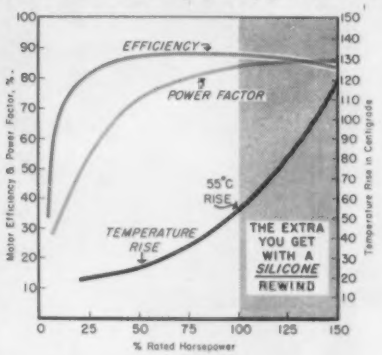
Where motors in your plant have failed because of increased production schedules . . . a change in processing or machining techniques . . . rapid reversing . . . jogging . . . inching . . . temporary or continuous overloading . . . a silicone rewind is the cost saving solution to minimum downtime and future reliability.

Or if you're planning new processes, new schedules that will increase horsepower requirement of existing motors, consider these facts: Your present motors can be rewound with silicones for a fraction of the price of new motors — and you save the cost of new motor pedestals and mounts, fittings, wiring and controls. Furthermore, you save considerable installation time and expense.

Silicone rewinds give reliable operation in almost any surrounding — regardless of high ambients, moisture, many corrosive atmospheres. For more information, and the name of Authorized Service Shops near you, contact Dow Corning, Dept. 3923.



SERVICE SHOPS identified by this gold emblem are experienced in rebuilding motors . . . in the use of silicone insulating materials to assure top quality performance.



MOTORS REWOUND with Dow Corning Silicones give up to 50% more horsepower. Efficiencies and Power Factors are comparable to those at full load ratings of motors as originally supplied. Only the insulation changes. The extra thermal stability of silicones increases motor capability.



SILICONE REWINDS consistently produce outstanding results such as these: To increase pumping capacity 30%, thirty-one 50 and 60 horsepower pump motors were rewound with silicones — boosting their output from 50 to 75 horsepower, from 60 to 90 horsepower. Total cost was only $19,000 compared to $68,200 for new motors and mounts! After 4 years, the motors have proved 8 times more reliable!

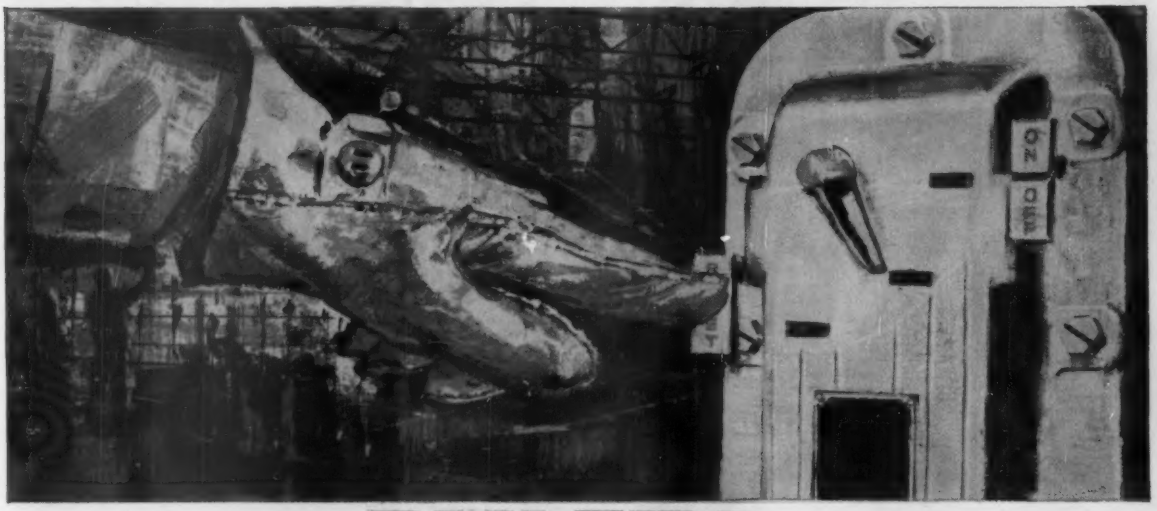
SPECIFY Dow Corning Silicones and **SAVE!**

first in silicones

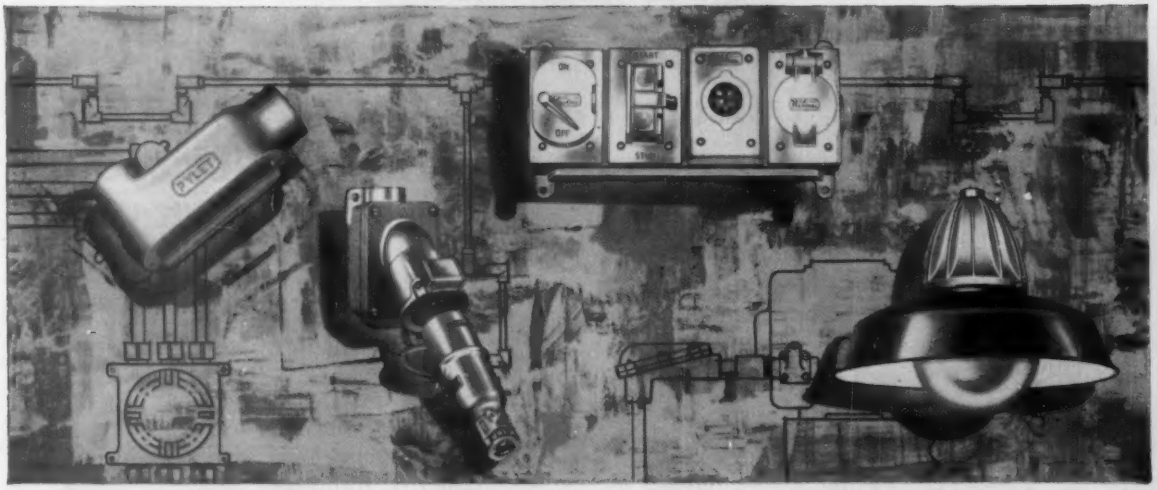
Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

For protection of wiring and equipment



you can rely on PYLETS®



PYLET conduit fittings, circuit controls, lighting fixtures and connectors are second to none for quality and dependable service.

Built-in, environment-resistant features exceed code requirements, to meet the exacting demands of industry today—for both hazardous and non-hazardous locations. Cast metal fittings with taper tapped hubs, smooth roomy interiors and cadmium plating insure economical installation and maintenance as well as long service life.

Specify PYLETS. Sold Nationally through Authorized Distributors.

THE PYLE-NATIONAL COMPANY
WHERE QUALITY IS TRADITIONAL

1344 North Kostner Avenue, Chicago 51, Illinois

Connectors • Conduit Fittings • Circuit Controls • Lighting Fixtures • Floodlights

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RELIABLE PRODUCT

RELIABLE SERVICE

Sola ballasts guard your reputation with low in-warranty failure ratio and immediate replacement service

Two-way reliability is an added bonus when you install, furnish, or specify Sola fluorescent ballasts. Records show in-warranty failures are remarkably rare. This product reliability and Sola's unique in-warranty service plan guard your reputation. The plan assures that lighting users anywhere in the country get fast replacement in those few cases where in-warranty failure of a Sola ballast may occur.

This plan is possible only because Sola's all-CBM-certified ballasts are conservatively designed to surpass CBM performance standards. They incorporate engineered reserve tolerances that mean cool, efficient, trouble-free service and full, rated light output even past the warranty period. Thus, the engineer, fixture manufacturer, and contractor can be confident that the lighting buyer gets all the light he's paying for with Sola-ballasted fixtures and lamps. Call your district sales engineer for the facts. ***Sola Electric Co.*** (A Division of Basic Products Corporation) ***4633 W. 16th Street, Chicago 50, Illinois.***

SOLA BALLASTS

PUSHBUTTON BAKERY fully equipped with Cutler-Hammer UNITROL®



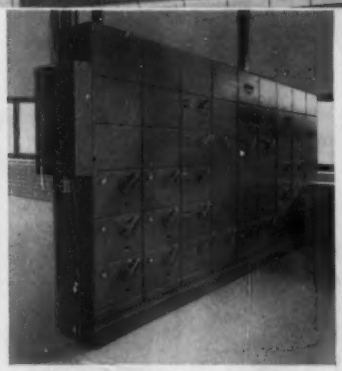
Mr. Minos Asproyerakas
Vice President & Chief Engineer,
National Baking Company, Chicago, Illinois
"The extent to which we have standardized on Cutler-Hammer Unitrol simply reflects our conviction it is the most economical and dependable system of control available."

UNITROL . . . *first* in performance—This 8-section Unitrol Control Center directs and protects the sequenced operations of each of the three automatic ovens. "The performance of this control equipment has been remarkable," reports Mr. Asproyerakas. "During the past two years we haven't even had to change a fuse or replace a single contact in any of the control units . . . and this includes those which must function 16 times a minute, 16 hours a day."





UNITROL . . . *first* in economy—Back-to-back mounting of the control units practically doubled the capacity of each Unitrol Control Center, saved valuable floor and wall area, and reduced installation time and costs. The back side of the Oven Control Center contains the control units for the plant air conditioning, and other services.



UNITROL . . . *first* in flexibility—Unitrol keeps pace with changing control requirements. Modular construction permits rapid rearrangement, addition, or replacement of individual control units as processes are modified and new machines installed. Control units for the fourth mixing machine will be added to this control center.



UNITROL . . . *first* in versatility—Only Unitrol solves so many control problems so well. This is the Control Center for the amazing "dial operated" handling system which selects, weighs, and directs the dry ingredients into the proper mixing machine. Special control units and relay panels fit perfectly into the standard Unitrol frame.

Welcome NECA Conventioneers! Stop in and see us at Booth #151

CUTLER-HAMMER CONTROL

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wis. • *Division:* **Airborne Instruments Laboratory.** • *Subsidiary:* **Cutler-Hammer International, C. A.**

Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation.



EASIER TO DO... and costs less too!

B-M
INDENTER FITTINGS and TOOLS

Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—Smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.



Red Throat
BM-21B
½" Connector



Red Throat
BM-22B
¾" Connector



Red Throat
BM-23B
1" Connector



BM-41
½" Coupling



BM-42
¾" Coupling



BM-43
1" Coupling



BM-51
½" Offset Connector



BM-21
½" Connector



BM-22
¾" Connector



BM-23
1" Connector



BM-No. 600
Changeable Jaw Indenter



BM-No. 1000
Handvise for ½", ¾" and 1" E.M.T.



BM-No. 100
Cutter for ½", ¾" and 1" E.M.T.



BM-No. 607
½" Indenter
BM-No. 608
¾" Indenter

UL

TELESCOPE BM SYSTEM

All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

BRIEGEL METHOD TOOL CO.
GALVA • ILLINOIS

KAISER ALUMINUM

KAISER ALUMINUM RIGID CONDUIT



IS A SURE BET TO LOWER COSTS

BECAUSE...

IT COSTS NO MORE TO BUY



And IT OFFERS COMPLETE ASSURANCE

Contractors everywhere are finding that the old ways aren't necessarily the best ways when it comes to buying and installing rigid conduit. The big money-saver is aluminum . . . for good reasons.

1 *Low initial cost.*

Today, aluminum conduit costs no more than steel . . . an important factor to consider when figuring your bid.

2 *Lower installed cost.*

Aluminum conduit weighs only *one-third as much* as the same size steel conduit. Result: easier handling . . . less worker fatigue . . . easier cutting, threading, bending . . . faster, more economical installation.

3 *Lower maintenance costs.*

Because aluminum conduit can't rust and is highly resistant to corrosion, maintenance and replacement costs are virtually eliminated. Aluminum never needs painting, keeps its look of quality for years. Other quality features: aluminum conduit is nonmagnetic, which reduces voltage drop; non-sparking for safe use in hazardous locations.

IT COSTS LESS TO INSTALL

OF A QUALITY INSTALLATION!



10-ft. section of 4-inch aluminum conduit weighs only 34 lbs.; steel—98 lbs.



Aluminum conduit can't rust, resists corrosion—saves maintenance dollars.



Aluminum conduit is easy to work with—saves labor, time and money.

KAISER ALUMINUM

THE BRIGHT STAR OF METALS

See "MAVERICK" • Sunday Evenings • ABC-TV Network

HERE'S HOW TO START SAVING MONEY NOW...

SEE THIS MAN BEFORE YOU BID ANOTHER JOB!



HERE'S HOW TO START SAVING MONEY NOW...

The man to see before you bid on another job is your Kaiser Aluminum Electrical Distributor. Compare prices—see how Kaiser Aluminum rigid conduit can give you the competitive edge on any contract.

Your Kaiser Aluminum Distributor has a complete stock of aluminum conduit sizes and fittings—*ready right now for delivery to your job site.*

See or call him today. Ask for a free copy of the Kaiser Aluminum Rigid Conduit Brochure containing comparative weights, installation details, and all the facts you need to lower your costs.

Start saving money now!

Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California.

KAISER ALUMINUM
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See "MAVERICK" • Sunday Evenings • ABC-TV Network

Tape it easy, Mac!

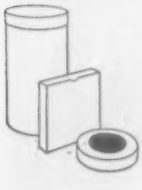


Gold Seal Tape sticks tight in any weather

You can do a first-class insulating job — easier and faster — with Gold Seal Friction Tape. It tears evenly, conforms readily to uneven surfaces, sticks *tight* in any temperature and under all weather conditions. And one thickness *insulates.* For lasting "tack", for all-around insulation protection, ask for Gold Seal Friction Tape. Made by Jenkins Bros., Rubber Division, 100 Park Avenue, New York 17.



In 10-roll containers or single rolls • Each roll sealed in cellophane, stays fresh



Gold Seal Tape

Gold Seal **FRICTION** • *Rubber • Plastic Tapes...Commercial and Specifications Grades*





"Pre-wired telephone outlets? They're a standard feature of every home we build!"

—SAYS PHIL JONES, CUSTOM BUILDER OF INDIANAPOLIS, INDIANA

"You're not offering the buyer a really modern home unless you provide for his telephone convenience," says builder Phil Jones. "That means giving him built-in, pre-wired telephone outlets in key areas of his home, just as you give him pre-wired electrical outlets."

Phil Jones builds custom homes priced from $21,000 up, and every one has from three to five outlets for telephone service. "I let the buyer tell *me* where he wants them located," he says. "After all, *he's* going to use them.

"Pre-wiring makes good sense. People like the idea—and I use it as a solid, competitive sales advantage."

* * *

Your local Telephone Business Office will gladly help you with telephone planning for your homes. For details on home telephone installations, see Sweet's Light Construction File 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

BELL TELEPHONE SYSTEM

At left, Phil Jones and telephone company man Bob Hill discuss outlet locations. Below is one of the builder's handsome "Johnson Meadows" homes.



RLM Quality Fixtures

made by these MANUFACTURERS

are now **MORE IMPORTANT** than ever!



YES! The new, much higher Industrial Lighting levels now recommended by I.E.S.* make QUALITY more important than ever!

Q *Why is reliance on fixtures with the RLM LABEL more important than ever?*

A *Because RLM TECHNICAL COMMITTEES have* for many years recognized the need for higher footcandles in industrial lighting and have been continuously revising upward the RLM Specifications for existing equipment and developing new specifications for new types of units. RLM Labeled units are ready to meet the task of re-lighting Industrial America to the new higher I.E.S.* recommendations.

Q *How can I BEST OBTAIN information on RLM Specifications and I.E.S. Recommendations?*

A *By mailing the COUPON TODAY.*

Be sure to check all items on which you desire information.

**The Illuminating Engineering Society is a non-profit organization of illuminating engineers and others interested in the advancement of the science of illumination.*

INCANDESCENT RLM SPECIFICATIONS — #1 150-1500w. Domes; #2 150-1500w. Deep Bowl; #3 300-1500w. Sym. Angle; #4 750-1500w. High Bay; #18 300-1500w. Glassteel Diffuser; #40 300-1500w. Semi-Direct-Ang.*; #41 300-1500w. Metal High Bay*

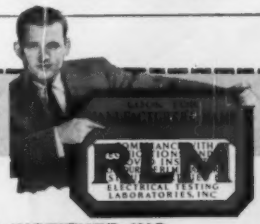
FLUORESCENT RLM SPECIFICATIONS — 0-30% UPLIGHT: D-1 2-40w. 1A-1B; D-1 2-73w. 1D; D-1 2 800 ma. 1E; D-2 3-40w. 2A-2B; D-2 3-73w. 2D; D-2 3 800 ma. 2E; D-3 3 90 ma. 40w. 3A-3B; 30-30% UPLIGHT: SD-1 2-40w. 1A-1B; SD-1 2-73w. 1D; SD-1 2 800 ma. 1E

This label identifies the RLM-certified lighting equipment of 24 leading manufacturers.

#1	#2	#3	#4	#18	#40	#41		D-1 2-40w. 1A-1B	D-1 2-73w. 1D	D-1 2 800 ma. 1E	D-2 3-40w. 2A-2B	D-2 3-73w. 2D	D-2 3 800 ma. 2E	D-3 3 90 ma. 40w. 3A-3B	SD-1 2-40w. 1A-1B	SD-1 2-73w. 1D	SD-1 2 800 ma. 1E
5	3	1	2		3		ABOLITE										
4	5	2		1			APPLETON										
5	4	4		1			BENJAMIN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
							CURTIS-ALLBRITE LTG.	✓	✓	✓	✓	✓	✓		✓	✓	✓
4	4						ELECTRO	✓	✓	✓	✓			✓	✓	✓	✓
							ENDER-MONARCH	✓	✓		✓						
							GUTH	✓	✓	✓	✓	✓	✓		✓	✓	✓
							KEYSTONE	✓	✓		✓	✓			✓	✓	
							LIGHTING DYNAMICS	✓	✓		✓	✓			✓	✓	
4			2				MILLER										
4					1		MULTI	✓									
4	4	3					OVERHAGH & AYRES										
6	4	6	3	2			QUADRANGLE										
							RUBY-PHILITE	✓	✓	✓	✓	✓			✓		
							SMITHCRAFT	✓	✓	✓	✓	✓			✓	✓	✓
5	3	3					SMOOT-HOLMAN	✓	✓	✓	✓	✓	✓		✓	✓	✓
4	1		1				SPERO										
5		2	2		4	2	STEBER										
							SUNBEAM	✓	✓	✓	✓	✓	✓		✓	✓	✓
							SYLVANIA	✓			✓			✓	✓	✓	✓
4	1	1			1		WAKEFIELD	✓	✓	✓							
5	4	2		2			WESTINGHOUSE	✓	✓	✓	✓	✓	✓		✓	✓	✓
5	4	2					WHEELER-FULLERTON	✓	✓	✓	✓	✓	✓	✓	✓	✓	
							WORK-O-LITE	✓	✓	✓	✓	✓	✓				

*Aluminum Reflectors all others are Porcelain Enamel

NOTE: Many manufacturers make incandescent RLM Units for more than one lamp size. The numerals refer to the number of different size RLM Units which the manufacturer offers under the specification.



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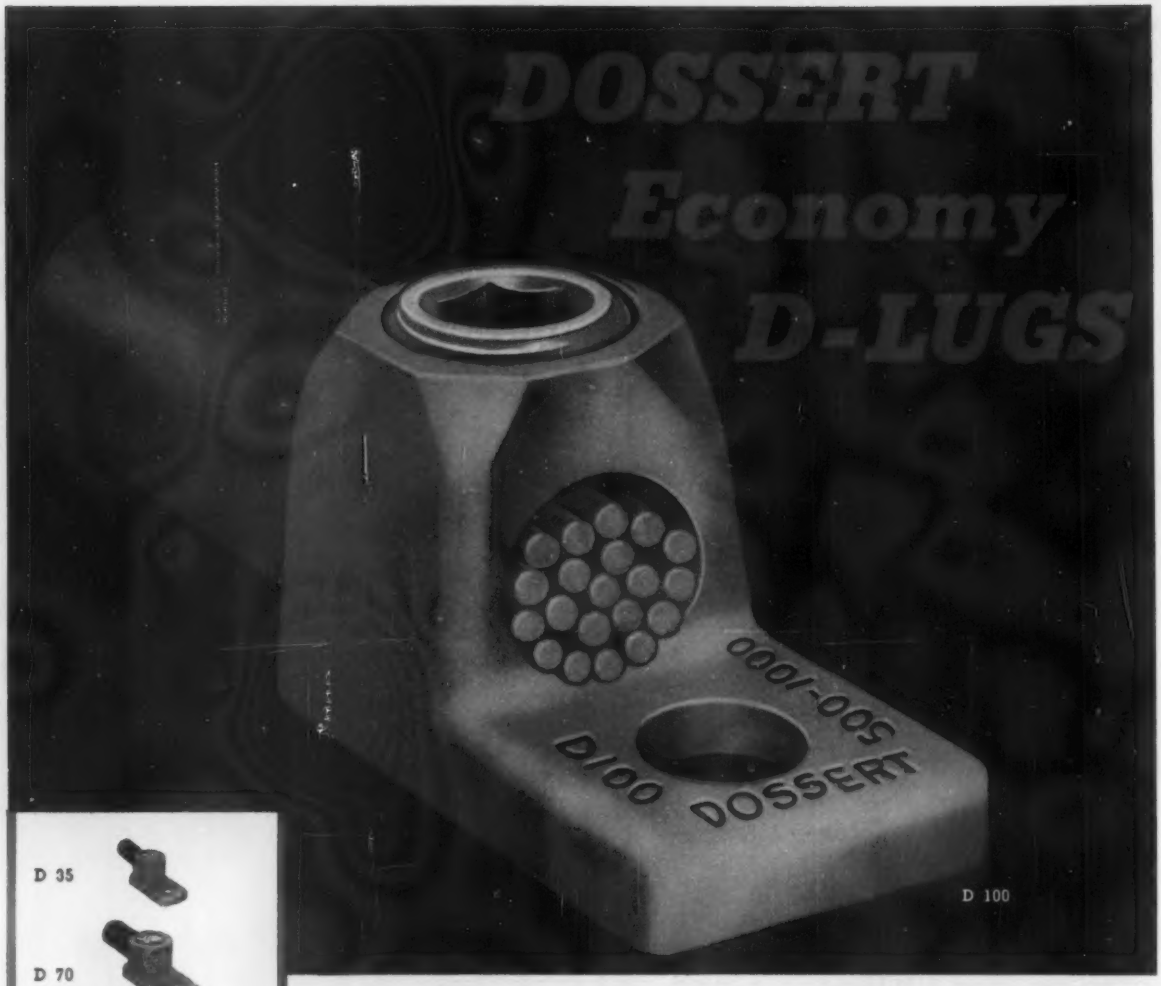
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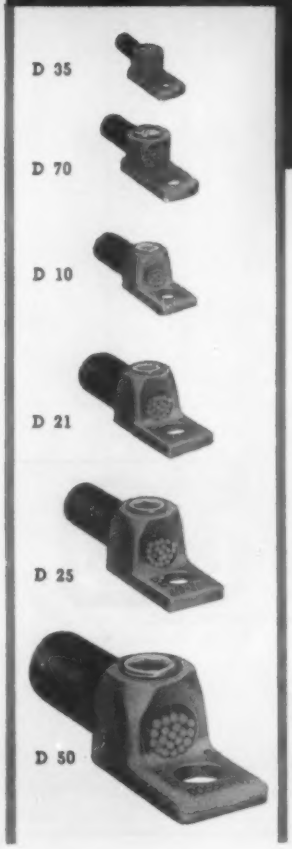
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R-887

RLM STANDARDS INSTITUTE

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Here is a complete and low-priced line of D-LUGS. These connectors are more compact and heavier in weight to insure cooler operation under more severe loads, while being much easier to install. Only seven sizes accommodate from 14 SOL. to 1,000,000 CM.

FEATURES:

- Rugged construction
- Made of high conductivity copper alloy
- Suitable for all purposes
- Variable, each connector takes wide range
- Exceptionally compact
- Reusable

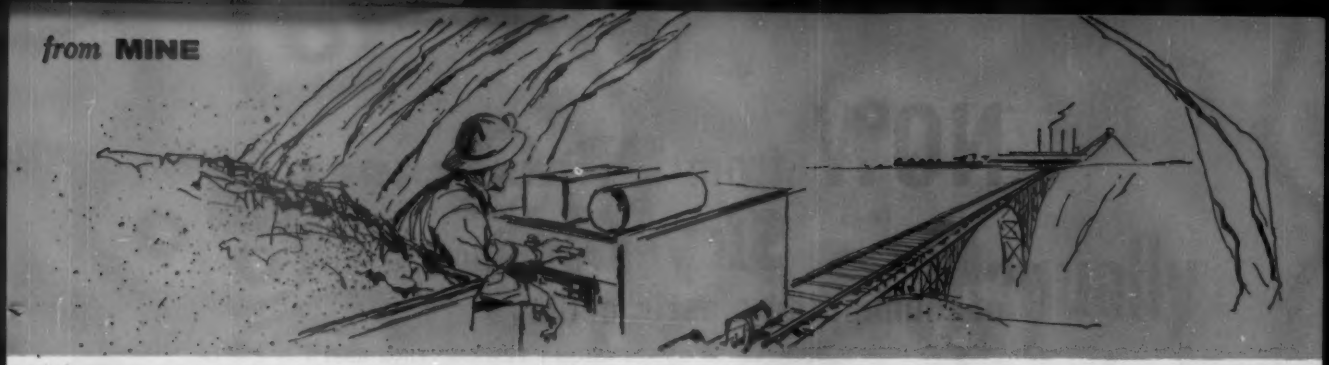
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Why don't *you* make a Circle distributor your "one sure source of supply." Many other satisfied contractors do.



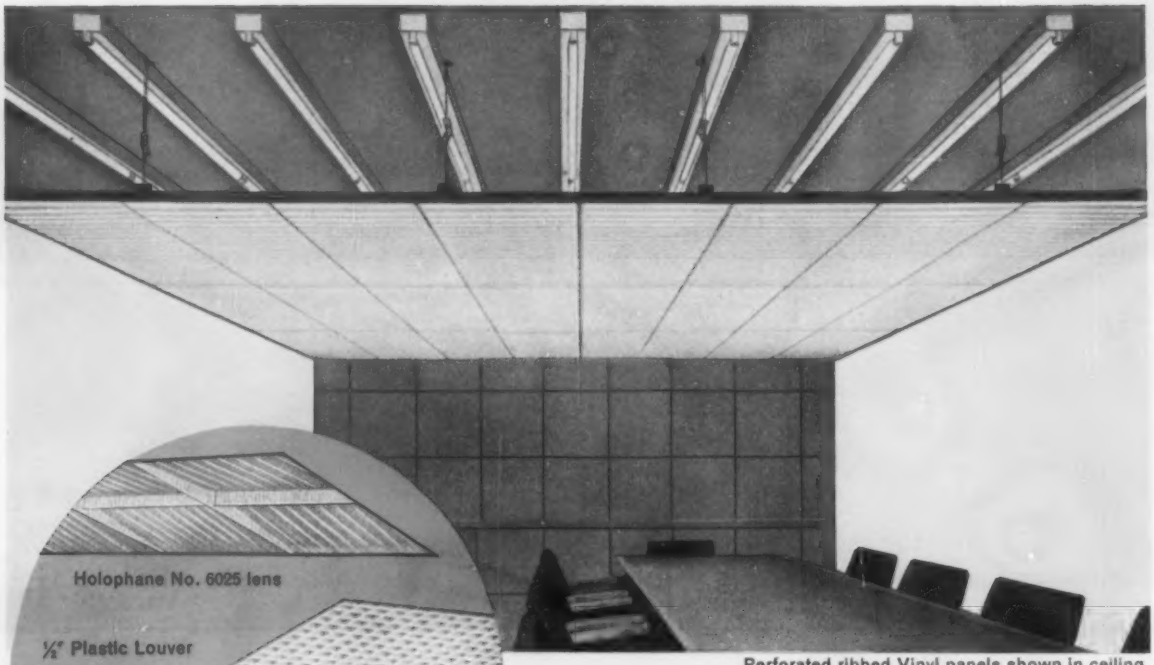
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- ✓ LOW SURFACE BRIGHTNESS
- ✓ LATEST DESIGN PLASTIC PANELS
- ✓ SHADOW FREE WALL TO WALL LIGHTING



Perforated ribbed Vinyl panels shown in ceiling

Simple T suspension hanger system

Sky-Glo, the ultimate in modern ceiling illumination. Easily installed 2′ x 4′ panels fit any room, providing shadow-free wall to wall illumination.

Ceiling grid of lightweight aluminum alloy, rigidly fastened with easy to use lock-tabs. Simplified spring steel leveling device quickly adjusts hanger length. A wide range of closures offers complete flexibility of ceiling type. *Priced by the square foot, complete with choice of Rapid-Start, Slimline, High Output or Power-Groove lamps.*

For fixture engineering at its finest, look to Benjamin. Your local Benjamin representative will be happy to help you. Contact him on any problem...large or small.

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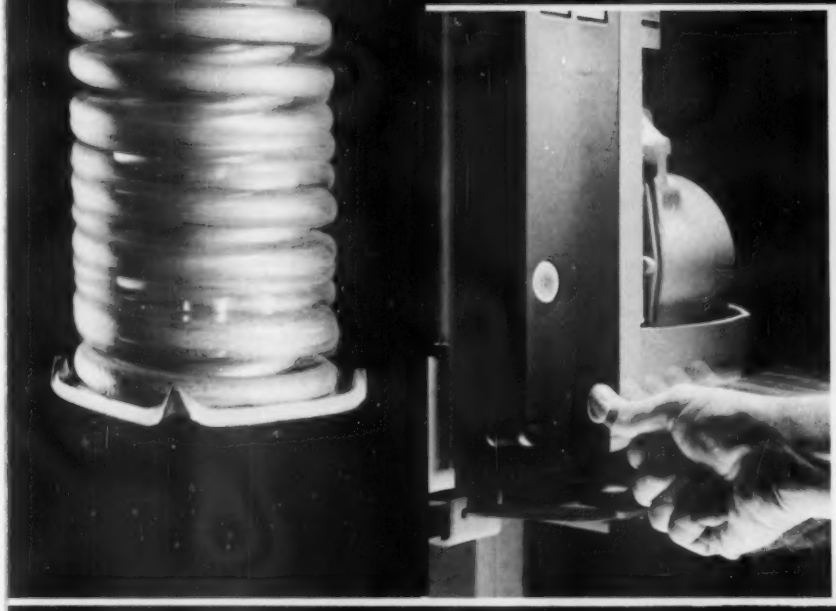
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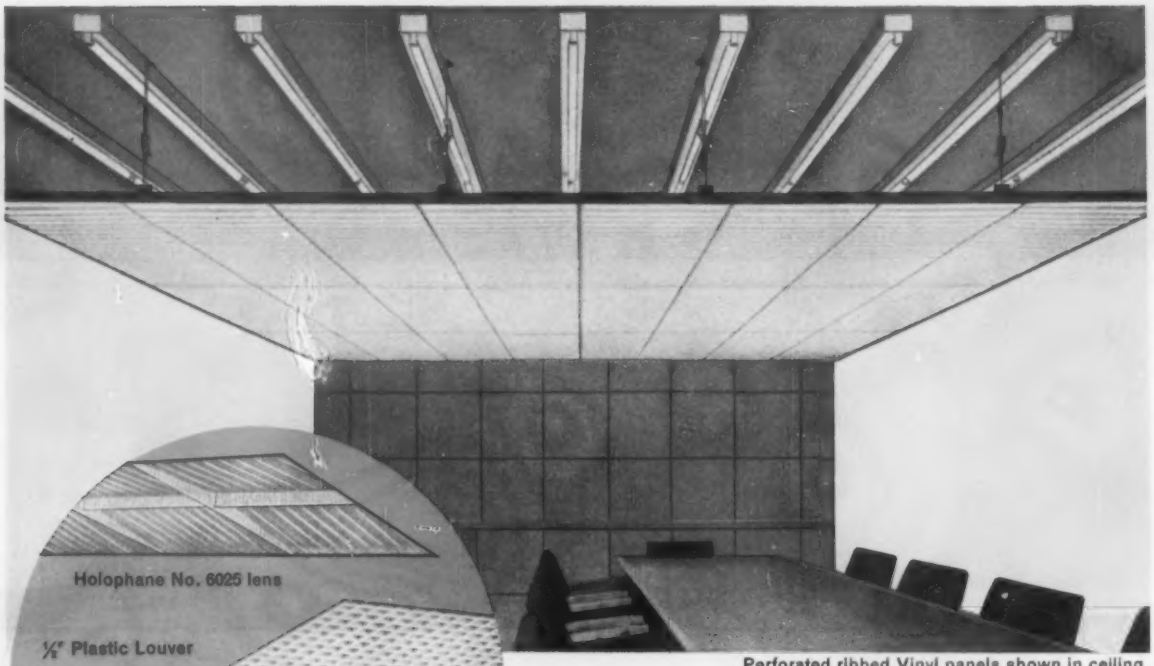
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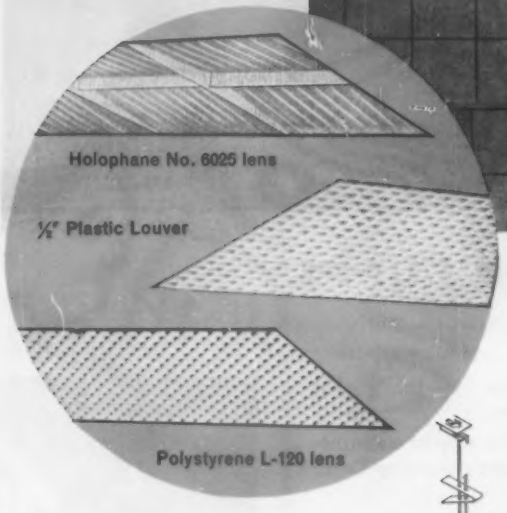
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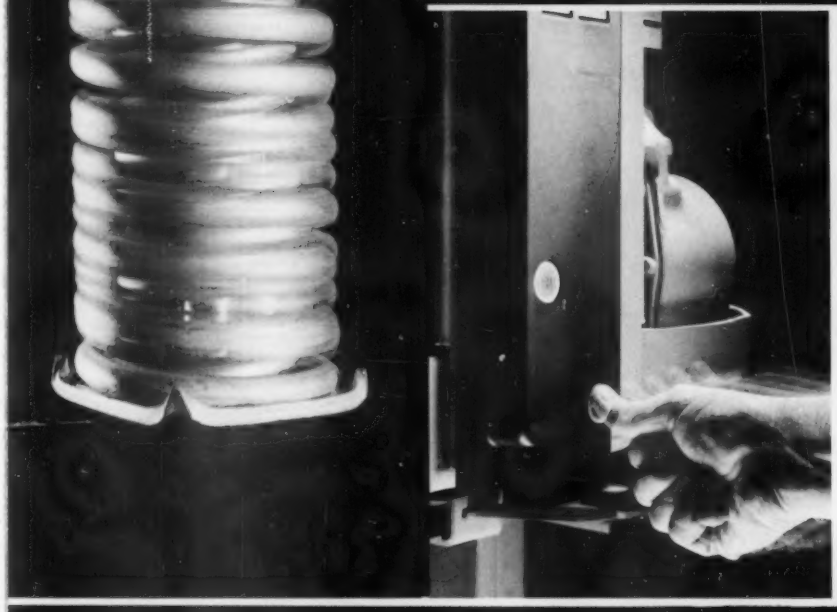
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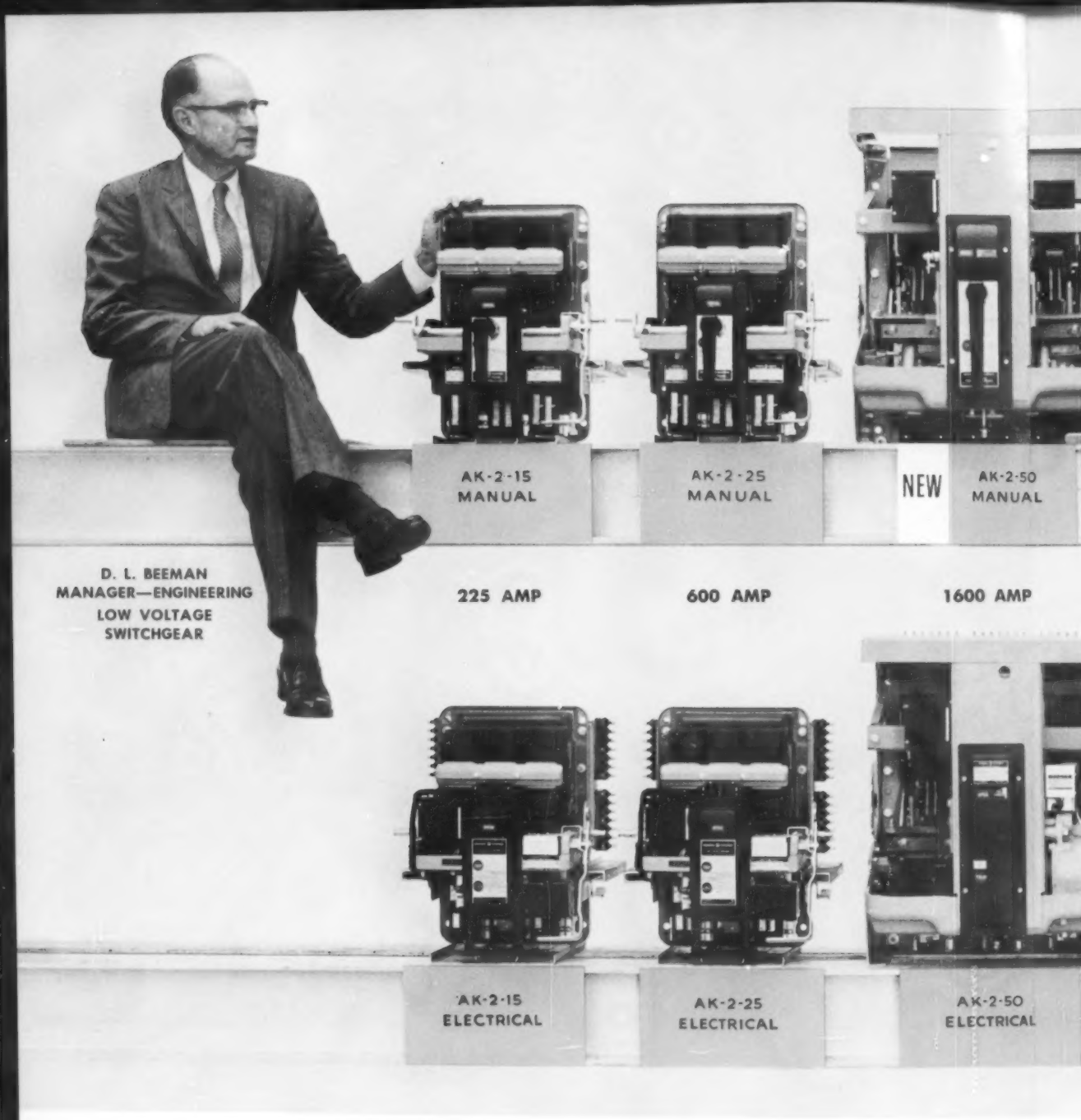


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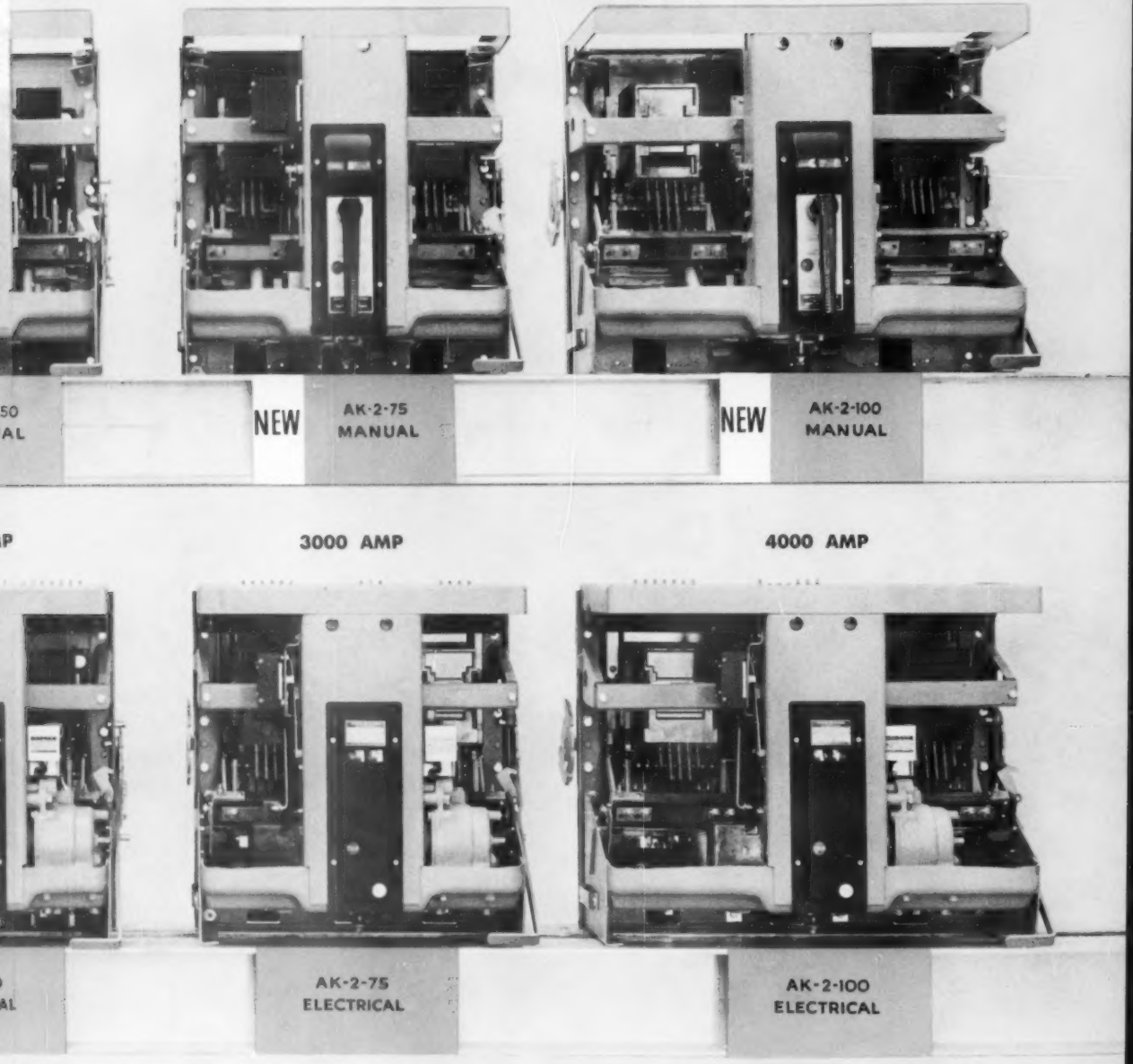
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Stored Energy in All These Breakers Means Better Protection at Lower Cost

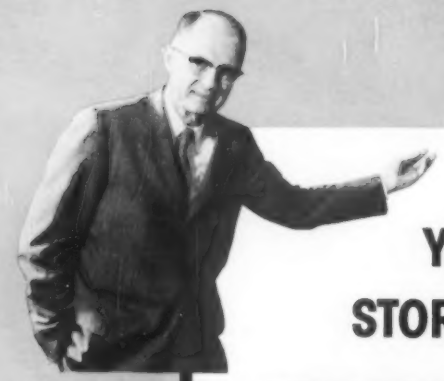


All General Electric power circuit breakers 600 volts and below now employ modern stored-energy (spring-close) mechanisms . . . which can be operated either manually or electrically.

General Electric AK-2 breakers with stored-energy give better service through increased safety, longer life, easier maintenance and application versatility.

TURN THE PAGE TO FIND OUT WHAT THIS FULL LINE CAN DO FOR YOUR SYSTEM.

GENERAL ELECTRIC



You'll Be Safer With STORED ENERGY Because...



THE SPRING SUPPLIES THE EXCLUSIVE CLOSING FORCE . . .



. . . WHETHER MANUALLY OPERATED . . .



. . . OR ELECTRICALLY OPERATED

The stored-energy breaker will last longer, need less attention because it closes with constant force.

You'll Save Money With MANUALLY OPERATED STORED ENERGY

- **SAVE** up to $500 per breaker position on preferred selective tripping systems.
- **SAVE** by using breakers for intermittent motor starters, often at lower cost than conventional motor starters.
- **SAVE** by substituting for more costly electrical breakers, when remote closing is not required.

534-1

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Progress Is Our Most Important Product

GENERAL ELECTRIC

Naugatuck KRALASTIC

Rubber-Resin



KRALASTIC conduit contributes to 43% savings

New York State Electric and Gas Corporation has learned how to install underground circuits for electric lighting faster, more economically, and with less disruption of landscaped property. A key to the operation is KRALASTIC.®

Used in place of conventional conduit, 20-foot lengths of KRALASTIC semi-rigid conduit are threaded over the cable, cut to length as needed, joined with a molded KRALASTIC slip fitting. All work is done above ground and the protected cable simply dropped into the trench. At driveways and similar obstacles, the conduit is snaked through a hole formed by a ⅝" rod and cone.

N.Y.S.E.& G. found 1½" conduit gave a saving of 15¢ per foot installed. Material costs were reduced further when conduit size was reduced to 1¼" and standard bases were fed by locally made long-radius bends. Additional savings resulted from the fact that conduit breakage during handling was eliminated, and KRALASTIC's light weight made it possible for a standard line truck to carry a full day's supply of conduit, eliminating the need for on-site storage and attendant problems.

Strength, light weight, and resistance to corrosive soils and chemicals are among the reasons why KRALASTIC has been steadily gaining popularity over both metals and other plastic materials not only for electrical conduit, but for municipal and home water service, well piping, salt water disposal, oil, gas, and chemical lines, radiant heating installations, piping applications by the hundreds.

Learn more of the many advantages KRALASTIC offers you. Contact your Naugatuck Representative or the address below today.

United States Rubber

Naugatuck Chemical Division

DEPT. 1134K ELM STREET
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KRALASTIC RUBBER-RESINS • **MARVINOL** VINYLS • **VIBRIN** POLYESTERS

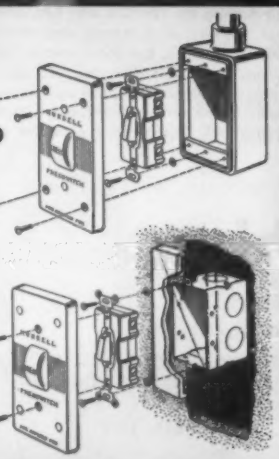
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WEATHER

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

FITS BOTH FS AND STANDARD WALL BOXES

Finned, self-sealing mounting holes permit the "Insulprene"-sheathed plate to be fastened to FS or standard wall boxes.





EXPOSED PASSAGEWAYS



LOADING PLATFORMS

PROOF

"INSULPRENE" PLATE WITH A.C. "PRESSWITCH"

SEALS OUT RAIN, SNOW, AND DUST

Moisture and dust cannot penetrate to the switching mechanism of this new Hubbell switch-and-plate combination.

The steel cover plate *and* the opening for the switch button are completely sheathed with a tough, flexible skin of "Insulprene", which prevents rusting and insulates wet hands from contact with metal. The "Presswitch" button is actuated simply by pressing the "Insulprene" bubble that covers it.

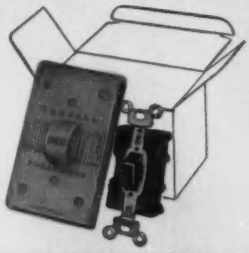
"Insulprene" is a DuPont neoprene-base plastic. It is non-conductive and highly resistant to impact, aging, oil, grease, live steam, hot water, extreme cold, heat and sunlight. For example, at the end of a 744-hour Atlas Weatherometer test simulating tropical rain and sunlight, the "Insulprene" bubble showed no significant loss of resiliency in operating the "Presswitch" button.

Hence this plate-and-switch combination is ideal for outdoor installations subject to severe weather conditions (−15° F to 150° F) or greasy hands (*filling stations, parking lots, garages, truck docks, playgrounds, sports fields, exposed passageways and breezeways*) or for indoor installations where humidity is high or temperatures are low (*dairies, freezer plants, cold-storage rooms, shower rooms, laundries, etc.*)

The switching mechanism is the fast-acting Hubbell "Presswitch", which responds to the gentlest touch of finger, hand, or elbow in any position. It is available in single or double pole, 3-way or 4-way action, in 15 or 20 ampere sizes for 120-277 volt A.C.

The "Insulprene" Plate and A.C. "Presswitch" combination is designed for FS or standard wall box mounting.

For further information about Hubbell rugged wiring devices, write to one of the offices listed below or refer to the Hubbell insert in the Architectural File of Sweet's Catalog (Sweet's No. 31b/Hu.)



PACKAGED TOGETHER FOR CONVENIENCE

The "Insulprene" Plate and A.C. "Presswitch" are delivered to the job as a unit in this time-saving package, with complete mounting instructions for FS or standard wall boxes. Plate is available in gray (No. 1751) or in "Chem Marine" Yellow (No. 17CM51).

Words "Insulprene" and "Presswitch" are Hubbell trademarks.



DAIRIES



PATIOS OR SWIMMING POOLS

HARVEY HUBBELL,
INCORPORATED
BRIDGEPORT, CONNECTICUT

IN CANADA: SCARBOROUGH, ONTARIO

WAGNER Dry-Type *General Purpose* Transformers

...WHISPER WHILE THEY WORK

New... from Wagner... totally enclosed dry-type transformers *filled with epoxy compound*. Their designation: Type AE Single Phase, 1 to 10 Kva.

Use these transformers for all general purpose applications, including those where noise must be minimized. They have a low sound level . . . the result of encasing smaller Form W core and coils in solid epoxy compound. The compound insulates, reduces sound-producing vibration caused by core excitation . . . and provides enough support and mechanical strength to eliminate the need for metal framework and other sub-assemblies that are subject to vibration. *The result:* a whisper-quiet transformer that can be used anywhere, even in quiet areas of offices and hospitals.

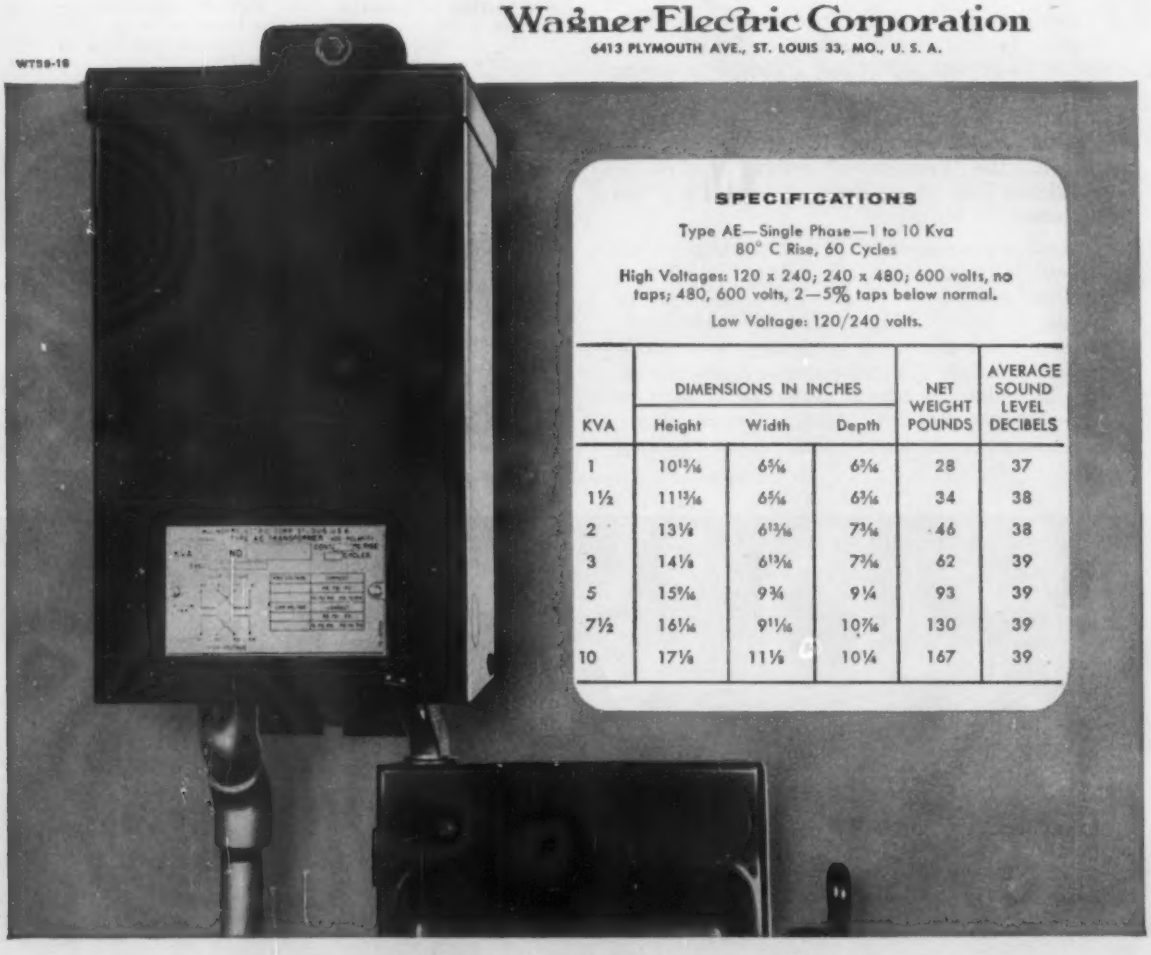
Wagner Type AE transformers do more than silence sound, of course. They improve voltage regulation, and have better insulation protection (suitable for continuous operation at 80°C in a 40°C ambient). All parts are sealed from dust, moisture and corrosion by the epoxy compound. Naturally, every unit is built to conform to all applicable standards of ASA and NEMA.

Wagner Type AE transformers can be installed indoors or out . . . in any location where they will not be submerged or exposed to injurious fumes in concentration. They are compact and lightweight and can be mounted in any position, at any angle . . . on walls, floors, or ceilings.

Like to know more? Wagner branches and distributors have all the details. There's one near you. Call or write now.

Wagner Electric Corporation
6413 PLYMOUTH AVE., ST. LOUIS 33, MO., U. S. A.

WTS9-10



SPECIFICATIONS

Type AE—Single Phase—1 to 10 Kva
80° C Rise, 60 Cycles

High Voltages: 120 x 240; 240 x 480; 600 volts, no taps; 480, 600 volts, 2—5% taps below normal.

Low Voltage: 120/240 volts.

KVA	DIMENSIONS IN INCHES			NET WEIGHT POUNDS	AVERAGE SOUND LEVEL DECIBELS
	Height	Width	Depth		
1	10 13/16	6 5/16	6 3/16	28	37
1½	11 13/16	6 5/16	6 3/16	34	38
2	13 1/8	6 13/16	7 3/16	46	38
3	14 1/8	6 13/16	7 3/16	62	39
5	15 5/16	9 3/4	9 1/4	93	39
7½	16 1/16	9 11/16	10 7/16	130	39
10	17 1/8	11 1/8	10 1/4	167	39

FROM THE NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT...

NEWS about lighting's most versatile design elements



UNI-FRAME

recessed incandescent lens box line

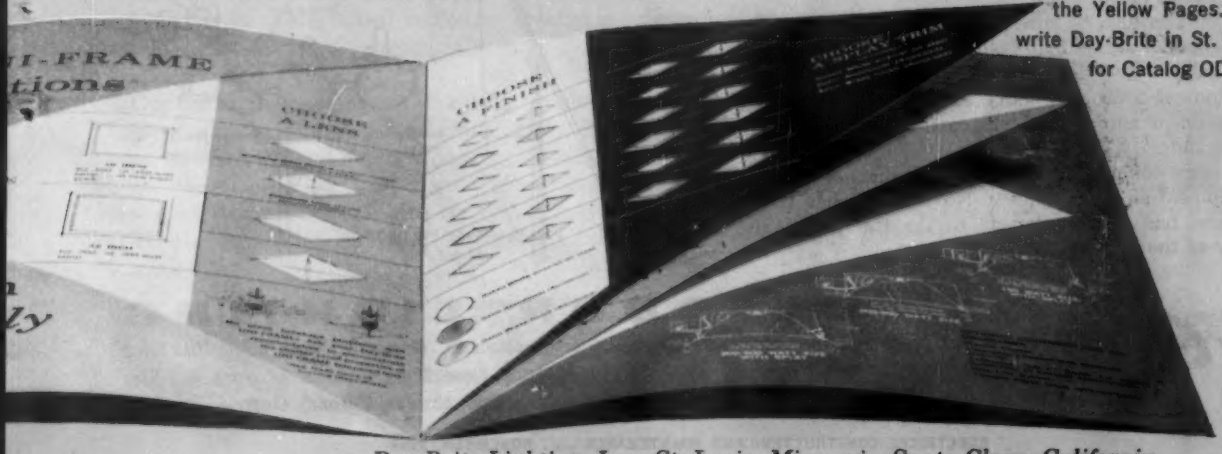
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DECIDEDLY BETTER
DAY-BRITE
LIGHTING FIXTURES

A-636

New smaller size for 100-150 watt lamps at lower price!
New diffusing glass bowl!
New matching splay trims!
New application ideas!
You'll find full details in this attractive UNI-FRAME booklet. Available from your Day-Brite representative listed in the Yellow Pages. Or write Day-Brite in St. Louis for Catalog OD-1036.

...and IDEAS on "how to" use them



Day-Brite Lighting, Inc. St. Louis, Missouri Santa Clara, California



There are two main considerations in lighting a drive-in restaurant. 1) Providing enough light for safe movement and parking of a large volume of traffic; 2) Providing a well-lighted area that readily identifies the drive-in and attracts passing motorists. The above drive-in accomplished this by mounting 3 floodlights and 5 clusterlites on each of 6 poles. Mounting height 33 feet, pole spacing 24 feet.

Revere matched outdoor lighting equipment means fast, trouble-free installation

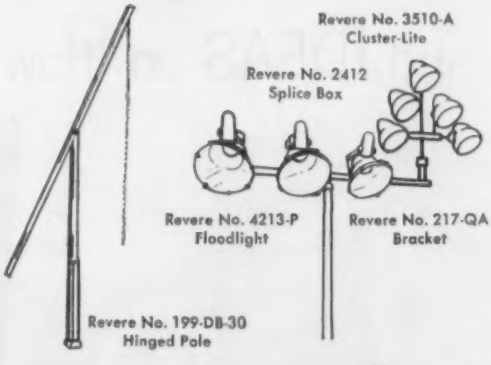
All components for the outdoor lighting installation shown above were made by Revere. All components—hinged poles, brackets, floodlights, cluster-lites and accessories—are made for each other.

By ordering your outdoor lighting from one reliable source, you can be sure that the equipment will fit together right when it gets to the job. This means fast, easy installation and less headaches for you.

You can also be sure that the components are structurally matched for strength and balance, and that they are matched in design for peak lighting efficiency and best appearance. All equipment from *one* source also means *one* delivery schedule from *one* manufacturer—all components reach the job at the same time.

Revere offers you the widest line of outdoor lighting equipment in the industry. No matter what the application, Revere has the equipment to do the job. Write for your copy of the Revere Catalog.

Revere components used in lighting drive-in restaurant



Revere ELECTRIC MFG CO

OUTDOOR LIGHTING

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois (In suburban Niles)
Long Distance Phone: NIles 7-6060 • Chicago Phone: SPring 4-1200 • Telegrams: WUX Niles
In Canada: Curtis Lighting, Ltd., Leaside, Toronto, Ontario

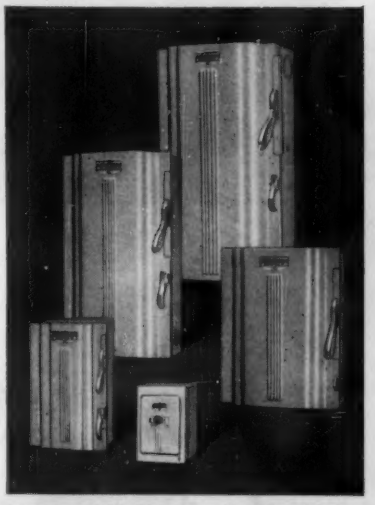


"How can safety switches wear out? . . . They never seem to be doing anything"

The fact that safety switches seem to be doing nothing at all until an emergency arises and somebody rushes to "pull the switch" is very deceptive. Actually, safety switches *work* every minute they are in service, fighting the ravages of unavoidable internal heating . . . and how well they are built decides how much *safety* your customer has when he really needs it.

Normal full-load current passing through the fuses in a safety switch generates considerable heat, temperatures as high as 700° F are not uncommon. This is not a criticism of fuses because they must operate close to their *melting* point at full load if they are to function properly when an overload occurs. But the continual heating of the switch mechanism in the confined enclosure creates a serious *heat* problem. Metal parts warp and corrode. Contacts loosen, then either weld or *burn up*.

Cutler-Hammer engineers tackled the problem of internal heating and licked it. Cutler-Hammer *Heat-Proof* Safety Switches use only selected heat resistive materials and a design that conducts away the trapped heat. Why settle for less when Cutler-Hammer *Heat-Proof* Safety Switches cost no more. Write today for your handy selection guide, C-H Merchandiser, Pub. EA100-X241. Cutler-Hammer Inc., Milwaukee 1, Wis.



There's a Cutler-Hammer *Heat-Proof* Safety Switch built to serve every job requirement. Your careful selection guarantees your customer's safety.

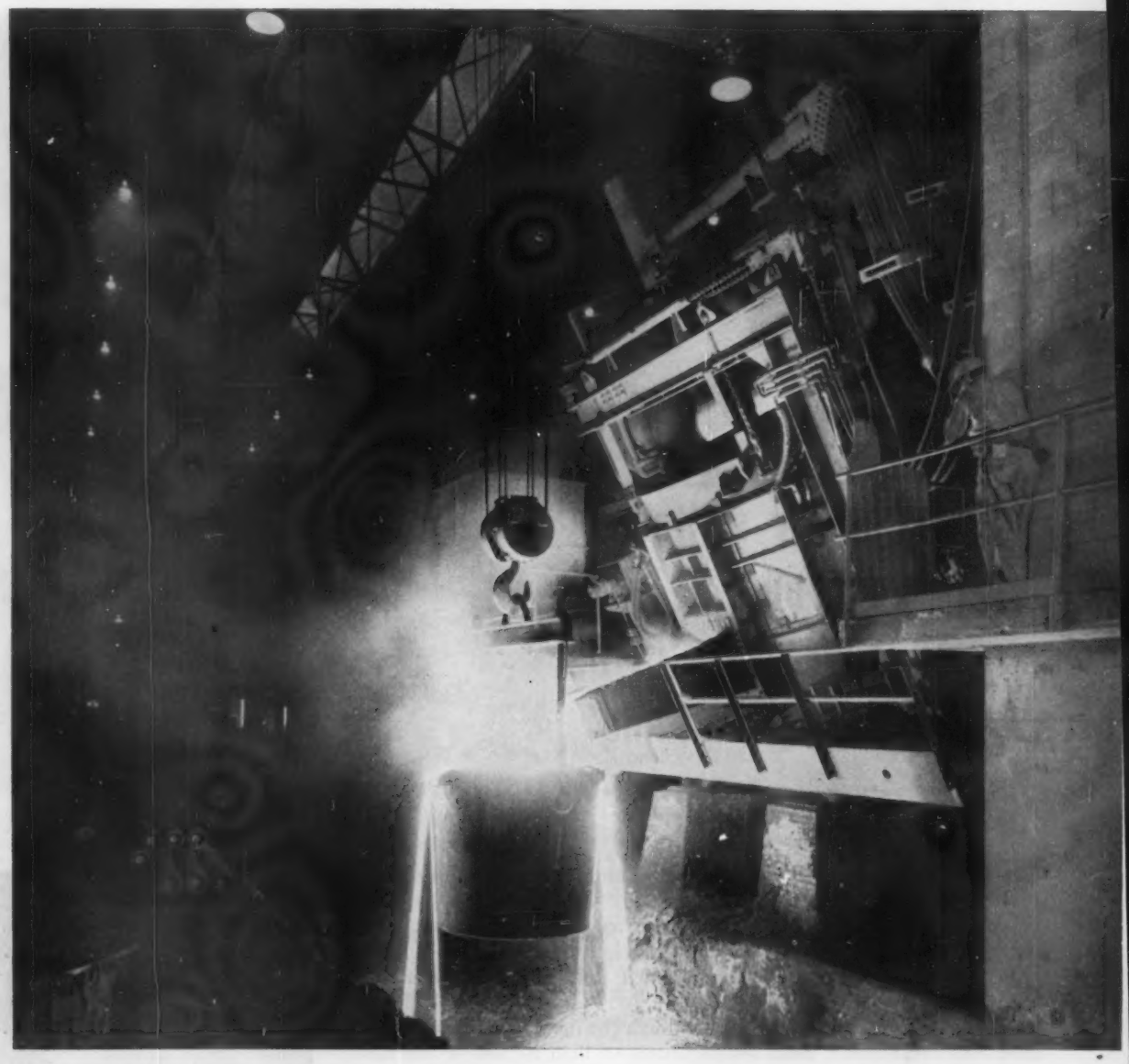
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CUTLER-HAMMER CONTROL C-H

CUTLER-HAMMER

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USS **Tiger Brand Electrical Wire & Cable**

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the difference in electrical cable?

New USS Tiger Brand Amerbestos—Type IPE withstands both high temperature and moisture

Type IPE stands for Irradiated Polyethylene. By combining IPE insulation with asbestos in our new Tiger Brand Amerbestos Cables, we get excellent resistance to both high temperature *and moisture.*

Conventional asbestos-varnished cambric cables were good for high operating temperatures but had little resistance to *moisture.*

The new irradiated polyethylene-asbestos cable, Type IPE, is superior in every way to conventional AVA cable and it costs you no more. You get the same physical dimensions, finished appearance, and safe operating temperatures.

Subjecting the polyethylene to a high voltage electron beam causes it to lose its thermoplastic nature, thus permitting its operation at much higher temperatures. Polyethylene so treated is known as "irradiated polyethylene" and the process has proved highly successful in severe field applications.

The big difference is that you can now use the cable for many more applications such as outdoor crane wiring, forced draft fan motors for boilers and other locations requiring high resistance to both heat *and moisture.* For more information, write American Steel & Wire, Dept. 9342, 614 Superior Ave., N. W., Cleveland 13, Ohio.

USS, Tiger Brand and Amerbestos are registered trademarks

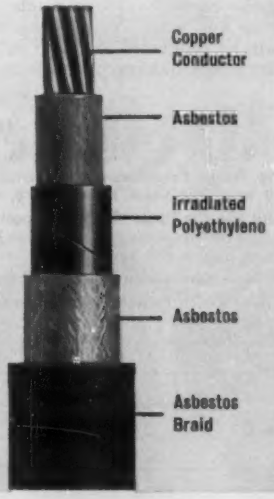
American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

Test results show superiority of Amerbestos Type IPE Cable

Three 5-foot samples each of Type IPE and Type AVA Cable were wound around a mandrel 8 times the diameter of the cable and then straightened. This was done on samples after heating 48 hours at 130°C. Samples were then immersed in water at 50°C for one week. Insulation resistance readings were taken during this immersion and directly before breakdown. The IPE polyethylene insulated cables retained their high insulation resistance averaging 333,000 megohms against 36.9 megohms for the varnished cambric AVA cables.

Dielectric Strength average: Polyethylene 31.2 KV, varnished cambric AVA 7.06 KV.





"Why chase them all? I know when I'm on the right track"

DODGE REPORTS put you on the trail of the profitable contracts

Thousands of contractors are discovering that *Dodge Reports* can be the key to more profitable bidding. Tired of relying on gossip... and waiting for invitations to bid ... they're using *Dodge Reports* to help them locate and size up building projects. With Dodge's dependable information, they don't miss good opportunities – and they know in advance which projects are right for them.

You, too, will turn up better bidding opportunities in your area – through *Dodge Reports*. You'll know what's coming up and when. You'll concentrate on the jobs you know will be profitable to you. You'll learn about the general contractors bidding on projects . . . who's bidding on the sub trades . . . and which ones get the contracts.

You get a separate *Dodge Report* on each individual project. The *Reports* are mailed to you daily. You get *Dodge Reports* only on buildings of the types in which you're interested – in the area where you want to do business. They tell who's going to build ... what's going to be built ... whom to see ... when bids are wanted ... and other important facts.

Let us show you how *Dodge Reports* can help you develop more – and better – bidding opportunities, and improve your profit picture, if you do business anywhere in the 37 Eastern states.

WRITE FOR FREE BOOK

F. W. Dodge Corporation, Construction News Division,
119 West 40th Street, New York 18, N. Y., Dept. ECM-119

Send me the book "Dodge Reports – How to Use Them Effectively" and let me see some typical Dodge Reports for my area. I am interested in the general markets checked below.

☐ House Construction ☐ General Building
☐ Engineering Projects (Heavy Construction)

Area_____

Name_____

Company_____

Address_____

City_____ Zone____ State_____



***FULL VALUE* FOR YOUR TRANSFORMER DOLLAR**

New G-E dry-type transformers 8 db quieter, up to 14% lighter



Quieter than ever; 14% lighter; built to last longer. That's the story of the all-new General Electric open dry-type transformers, completely redesigned to meet modern commercial and industrial requirements.

New sound levels are 8 db below published standards and G.E.'s new inorganic Alpholite insulation will not deteriorate with time or temperature—provides exceptionally long life for dry-type units. Aluminum conductors reduce transformer weight, simplifying mounting on balconies, catwalks, or overhead platforms.

G-E sealed dry-type transformers with these same superior features are recommended for use where dust- and dirt-laden atmospheric conditions exist.

Product leadership is just part of the story. General Electric's full line of transformers for industry* is certified to deliver **full value** for your transformer dollar . . . in terms of superior products . . . plus faster order handling and shipment . . . plus complete service before, during, and after installation. If you examine the **complete package,** we're confident you'll recognize the full value for your transformer dollar offered by General Electric.

For complete information and application help, see your G-E Apparatus Sales Engineer or Agent today. Or write to Sect. 417-8, General Electric Company, Schenectady 5, New York.

* **Medium transformers (501 to 7500 kva), Open dry-type transformers (300 to 7500 kva), Sealed dry-type transformers (300 to 7500 kva), Distribution Equipment transformers (112½ to 500 kva), Integral Distribution Centers.**

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SUPERIOR DESIGN, FEATURES, PERFORMANCE of General Electric transformers is typified by use of new inorganic Alpholite insulation (left) and sound level research.



FASTER SHIPMENT through rapid processing of orders . . . computer design . . . repetitive manufacture.



COMPLETE SERVICE . . . application engineers . . . installation engineers . . . 50 nearby service shops.

General Electric announces . . .



NEW DRAW-OUT DESIGN

From General Electric comes the all-new draw-out Limitamp control—today's most advanced medium-voltage motor starter. Designed for the control of a-c motors rated 2300 through 4600 volts and up to 3000 hp, this new air-break starter has broad application throughout industry.

Since its introduction in 1941, Limitamp control has established a reputation for being first with the design features that add up to major user benefits. And, today's all-new Limitamp control follows this pattern with a host of design innovations that make for:

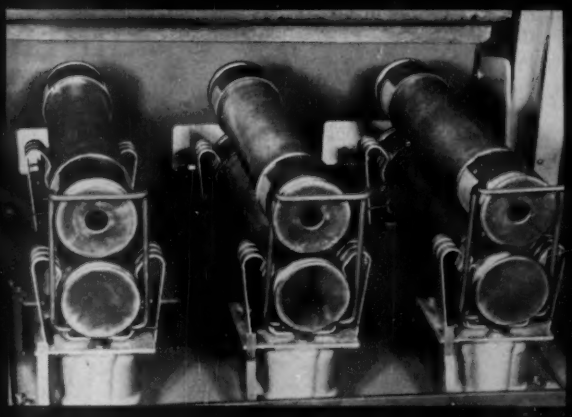
Faster installation: When you're ready to roll in the contactor—it can be done easily by one man. And, there are no connections to make—they are made automatically as the contactor rolls into place. There's plenty of space inside the panel for pulling the motor and power cables . . . and making the connections. And, with the new design, floor sills have been eliminated. This means no more grouting, no expensive cement work, simplified lineup with other panels.

Simpler, safer operation: One handle now controls the complete operation of connecting and disconnecting the starter from the bus and mechanically locking the high-voltage compartment door. A unique interlocking system protects the unit from misuse.

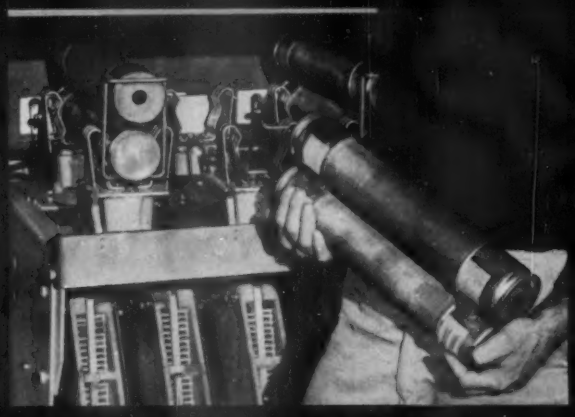
Superior protection: General Electric's new Limitamp



INSTALLS IN HALF THE TIME—Draw-out air break contactor, roomy isolated cable compartments, and increased working space help simplify installation.



LIMITAMP CONTROL IS ISOLATED AUTOMATICALLY—A unique shutter box isolates the starter from high-voltage power when the operating handle is turned to the off position.



INTERRUPTS FAULT IN FIRST ½ CYCLE—Fast-acting, current-limiting fuses interrupt circuit before short circuits cause damage to valuable motors.



NORMAL MAINTENANCE WITH CONTACTOR IN PLACE—All components, including the high-voltage contactor, can be maintained right in the control unit, with complete safety.

LIMITAMP* CONTROL

control utilizes fast-acting current-limiting fuses, ambient-compensated overload relays, and a high-voltage contactor to provide the most "positive" protection for your motors. Proved EJ-2 fuses interrupt a fault in the first ½ cycle, thus reducing damage to valuable motors. The performance of the completely coordinated design has been exhaustively tested in General Electric's high-voltage laboratory to provide the most reliable equipment for your application.

Easier maintenance: Even with these advanced design features, new Limitamp controls are simpler than ever to maintain. All components are accessible from the front for inspection and maintenance—without removing them from the enclosure. A special test circuit is built into each unit—permitting check-out operation before the unit is put into service.

For full information on all-new Limitamp motor control, contact your G-E Apparatus Sales Engineer or Agent today. Or write Sect. 783-10, General Electric Co., Schenectady, N. Y., for Bulletin GEA-6893. Industry Control Dept., Roanoke, Virginia.

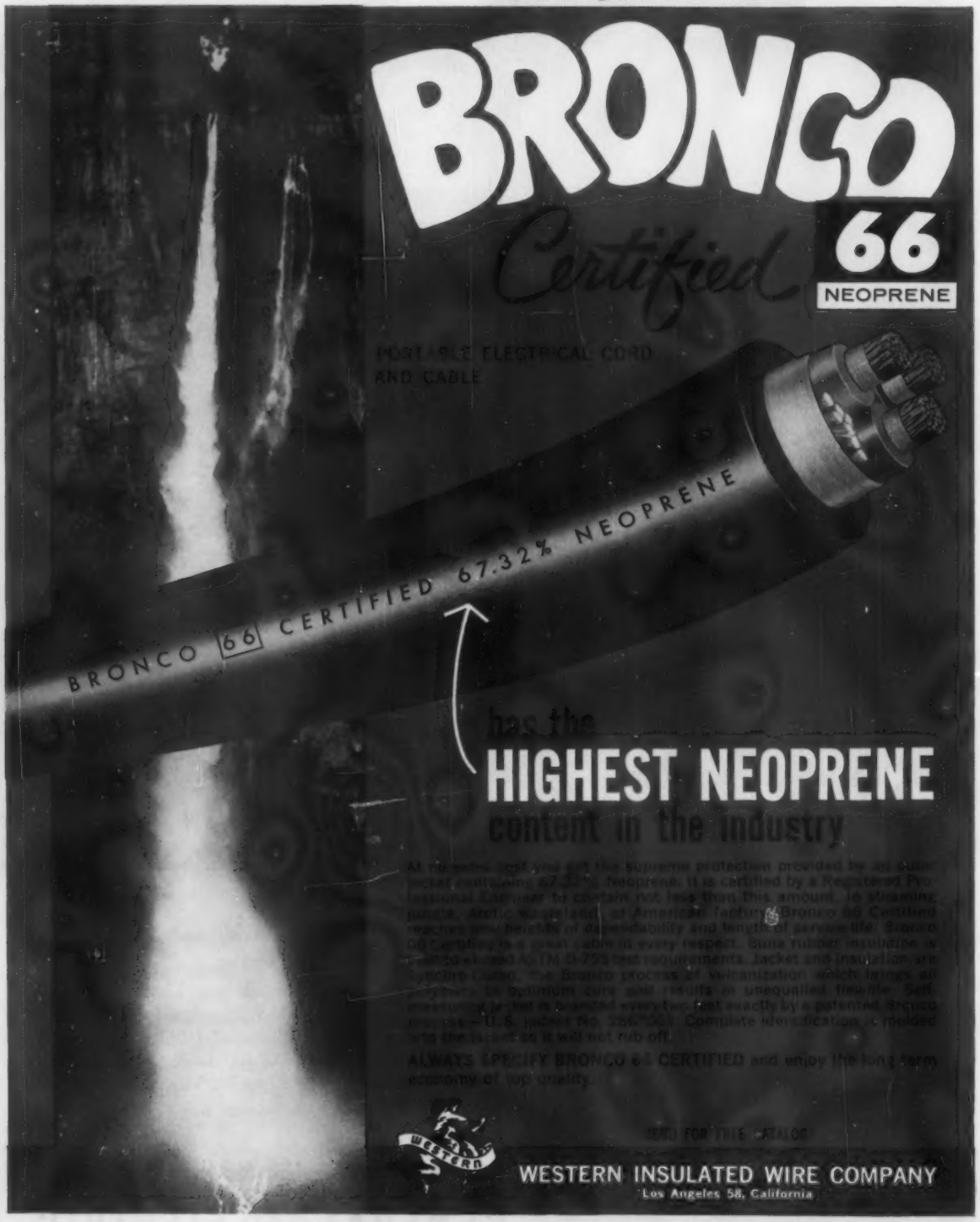
*Reg. trade-mark of General Electric Company.

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Angel Falls in Venezuela is the highest in the world, drops 3,212 feet. Surrounded by tangled, steaming jungle, it remained undiscovered until 1935 when James Angel, an American aviator hunting for gold, sighted the falls from his plane. It is 12 times higher than Niagara Falls.

ONLY ONE HIGHEST



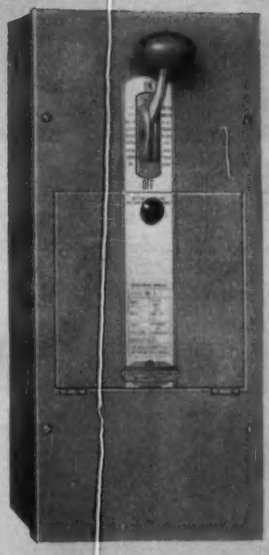
NOW, A COMPLETE LINE
of all 3 types!



★ LD (light duty)



★ SCSD (standard duty)



★ SAHD (heavy duty)

Dependable FRANK ADAM SAFETY SWITCHES

Now There's a Frank Adam Safety Switch for Every Need!

(Light Duty)	(Standard Duty)	(Heavy Duty)
30 to 200 amperes—240-v., A.C. Indoor and "Raintite".	30 to 200 amperes—240-v., A.C. or 600-v., A.C. Indoor and "Raintite".	30 to 1200 amperes—240-v., A.C. or 600-v., A.C. Indoor only, flush or surface mounting.

Regardless of the installation requirement—light, standard or heavy duty—there's a Frank Adam Safety Switch to give long-lasting, trouble-free service.

Frank Adam's *new* LD switch—plus the SCSD and SAHD switches—assures you of the same superior engineering and dependable performance on every job, large or small.

For more information see your wholesaler. He's ready to give you off-the-shelf delivery!

See our catalog in SWEET'S

FRANK ADAM ELECTRIC COMPANY
P.O. BOX 357, MAIN P.O. • ST. LOUIS 66, MO.

busduct • panelboards • switchboards • service equipment • safety switches • load centers • Quikheter

CONTRACTORS FIND: New G-E Plug-in Busway costs



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

H. P. Foley Co.
Wilmington, Del.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Eastern Electrical Construction Inc.
West Collingswood Heights, N. J.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Collins Electrical Construction Co.
St. Paul 7, Minn.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Hoffman & Son Inc.
Long Beach, Calif.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Libecap Electric Co., Inc.
Dallas 10, Texas



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Bliss & Sage Electrical
Malden, Mass.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

J. L. Krauser Co.
Portland 14, Oregon

GENERAL ELECTRIC SAYS: Try it - if it doesn't save you



Type DH Busway is rated 100 amperes, 3-wire, single or 3-phase, or 4-wire, 3-phase 600 volts maximum. It serves either as a feeder or plug-in system and may be used indoors wherever exposed wire and conduit could otherwise be applied.

Contractors say: "If you can do the job with wire and conduit, we find you can do it now with G.E.'s new 100-ampere plug-in busway—and save as much as 25%."

This is not poetic license. This is straight talk about actual dollar-and-cents savings.

Contractors all over the country are echoing this statement and reporting savings of this kind. Some contractors, after learning the facts, have actually switched to DH *on the job.*

The facts are simple, and to demonstrate them to you, General Electric makes this offer◆:

(1) Install, according to G-E installation instructions, 50 feet or more of Type DH busway mounted edgewise on 10-foot centers and where approved by NEC and local codes.

(2) Compare the total cost of this DH installation with the cost you would have experienced had you purchased and used at the same time heavy-wall conduit and wire of equal ampere capacity. Base your comparison on the use of two or more tap-offs for each 50 feet of run and protective devices that are equivalent in quality and function.

(3) If the total installed cost of Type DH is more, General Electric will pay you the difference in cash.†

Try DH. You have nothing to lose — and much to gain.

◆*Offer limited to installations made between September 1, 1959 and December 31, 1959. Claims must be received by your distributor on or before January 4, 1960. Offer does not apply to installations made in New York, New York, Newark, New Jersey or the State of California.*

†**Example:** *Suppose DH costs you $250.00 installed and that you determine an equivalent run of wire and conduit would have cost you $230.00. The difference is $20, which General Electric would pay you in cash.*

For further details, see your G-E representative or distributor. Ask for Bulletin GEA-6172 — or contact Distribution Assemblies Department, General Electric Company, Plainville, Conn.

less installed than wire and conduit!



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

West Electrical Construction Co.
Tulsa, Oklahoma



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Cooper Electrical Construction Co.
Greensboro, N. C.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Peifer Electric Co.
Trenton, New Jersey



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Brooker Electric Co., Inc.
Detroit 7, Michigan



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Fisk Electric Co.
Houston, Texas



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

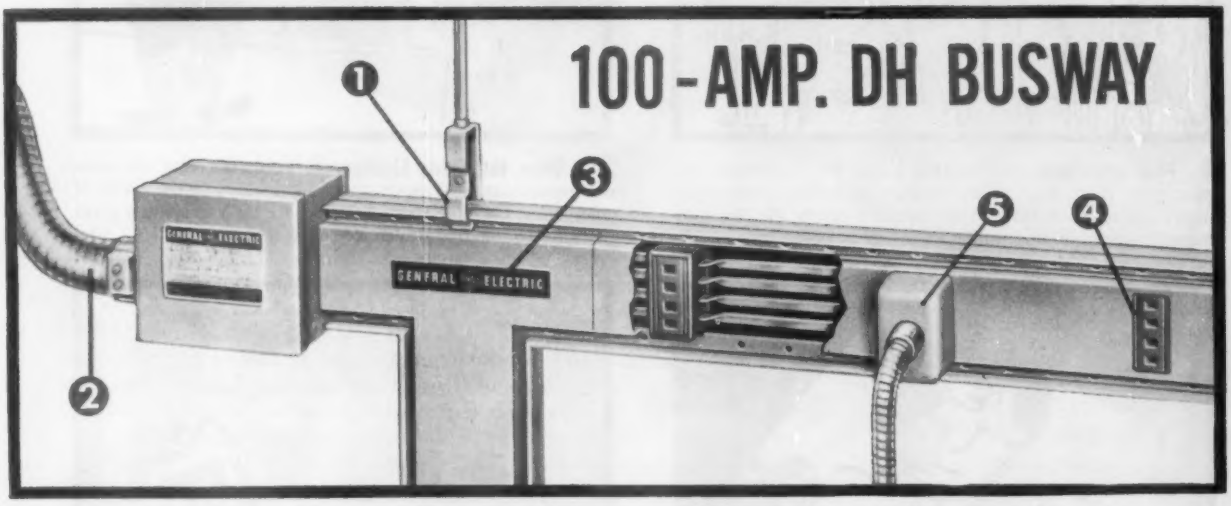
Loomis Electric Co.
Akron, Ohio



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Charles Electric Co.
Hartford 6, Conn.

money, G.E. will pay the difference in cash!



Easy to install because:

1. snap-on hangers save time.
2. flexible fittings and adjustable length eliminate need for exact measurements.
- mechanical and electrical joint connections are made simply by tightening six screws.
- light weight (27 pounds per 10-foot length) and small size make for easy handling.
- approved for mounting edgewise on 10-foot intervals instead of usual five.

Flexible because:

3. standard fittings—both rigid and flexible—allow run to be tailored quickly to virtually any building contour.
- each 10-foot length has 18 outlets, nine on each side.
- lengths can be removed from run without disturbing adjacent lengths.
- same current rating in any position.
- 1-, 2-, 3-, 5- and 10-foot lengths.

Safe because:

4. outlets are virtually "dead front" even after covers are removed.
5. plugs are totally enclosed and polarized.
- 15,000-ampere short circuit rating standard (100,000 when protected by CLF fuses).
- entire system listed by Underwriters' Laboratories, Inc.

Salvable because:

- entire run can be taken down, moved to new locations and re-installed with complete re-use.

Easy to order because:

- DH is stocked nationwide by G-E distributors.

GENERAL ELECTRIC

HOW TO MAKE A MINT OF MONEY SELLING EXIDE LIGHTGUARD® UNITS





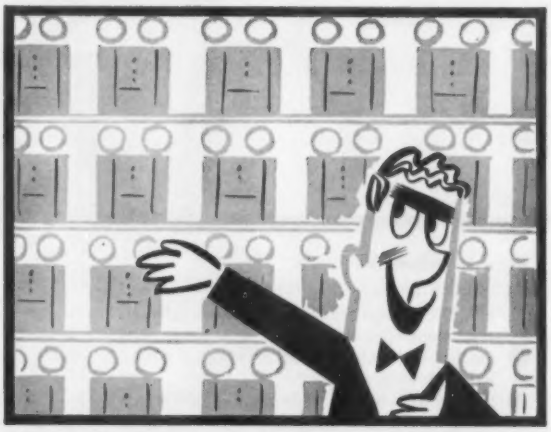
1. Find prospects everywhere. Look for buildings with people in them and where sudden darkness could cause injury, damage or theft. This includes nearly all the commercial, industrial and public buildings in your area.



2. Show the Exide Lightguard. Point out that its superior power capacity means more light-hours in the event of emergency. Genuine Exide battery with built-in charger gives years of trouble-free protection.



3. Demonstrate the Exide Lightguard. Plug it into a light socket, then switch off the power. Show how the Exide Lightguard goes on instantly and automatically. Floods an area with light till power comes back on.



4. Ask how many the customer needs. You'll find most users will buy several—one for each area to be protected. Many orders will run to important money. So selling Exide Lightguard units can be profitable business.

Here's your market:

Every business, factory, office, institution, theater, school, church. If they don't have emergency light now, you can be sure they need it. And they're better off if they buy Exide Lightguard. Why don't you be the one to sell it to them. For information on becoming an Exide Lightguard dealer, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

Exide®

KRALOY...

FIRST PVC RIGID CONDUIT INSPECTED AND PASSED BY UNDERWRITERS LABORATORIES!



Only KRALOY, yes *only* KRALOY, among all plastic conduits, now carries U-L listing — another first for KRALOY! High impact KRALOY PVC (Polyvinyl Chloride) RIGID CONDUIT... the *lifetime* conduit... the *perfect* conduit... won't rust, won't pit, won't corrode, won't support combustion, is non-magnetic and non-sparking. KRALOY needs no paint, no coating, needs no lining, and its mirror-smooth inside wall makes fishing easier than with any other type of conduit. Add these outstanding features to KRALOY's extreme light weight (see chart below) and you have the *ideal* conduit... ideal for direct burial and slab work. Installation costs can be cut *drastically* with light weight KRALOY PVC RIGID CONDUIT. Consider the dollars to be saved in handling and installing U-L listed KRALOY CONDUIT Cat. No. KE-1058 versus steel, *versus even aluminum conduit:*

KRALOY PVC CONDUIT is sold only through wholesale electrical supply houses.

NOTE WEIGHT COMPARISON — KRALOY PVC vs. ALUMINUM vs. STEEL CONDUIT

U.L. required minimum weight per 100 ft. including couplings, lbs.

K-59-29

Trade Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	5"	6"
KRALOY PVC	15.0	20.0	29.0	40.0	47.0	63.0	101.0	131.0	159.0	187.0	253.0	326.0
ALUMINUM	27.4	36.4	53.0	69.6	86.2	115.7	182.5	238.9	287.7	340.0	465.4	612.9
STEEL	79.0	105.0	153.0	201.0	249.0	334.0	527.0	690.0	831.0	982.0	1334.0	1771.0

For complete information on KRALOY PVC CONDUIT and installation directions, mail the coupon or write to Kraloy Plastic Pipe Co., Inc., 4720 East Washington Blvd., Dept. ECM-11, Los Angeles 22, Calif.



NO CONDUIT REPLACES **KRALOY**

Kraloy Plastic Pipe Co., Inc., Dept. ECM-11,
4720 East Washington Blvd., Los Angeles 22, Calif.

Gentlemen: Please send me your new Brochure on KRALOY PVC CONDUIT which gives complete information and installation directions.

Name_____

Address_____

City_____ Zone_____ State_____

ANOTHER ADVENTURE IN LOW-VOLTAGE WIRING WITH

REMMIE REMCON

and

ALEC TRISHUN

"The MISSING TRANSFORMER CAPER"

REMMIE... I NAILED THE MOUNTING BRACKET TO THE STUD AND STAPLED THE #18/3 WIRE FROM THIS SWITCH LOCATION TO THE OUTLET BOX. MAN, WHAT A SNAP! BUT, WHEN DO I RUN THE WIRES FROM THE TRANSFORMER?

YOU DON'T... NOT WITH **REMCON** REMOTE-CONTROL WIRING.

YOU MUST BE KIDDING... HOW COME, REMMIE?

THAT'S SIMPLE... WITH **REMCON,** THE TRANSFORMER IS **BUILT RIGHT INTO THE RELAY!**

I SEE... THE WIRING OF THE TRANSFORMER TO THE RELAY IS DONE RIGHT AT THE FACTORY. THAT REALLY SIMPLIFIES MATTERS.

YOU GOT IT, ALEC... NOW I'LL SHOW YOU HOW WE FINISH OFF THE JOB.

"HERE'S HOW EASY IT IS. JUST PULL THE LOW-VOLTAGE WIRE FROM THE SWITCH LOCATION THROUGH THE KNOCKOUT IN THE OUTLET BOX. THEN CONNECT THEM TO THE COLOR CODED LOW-VOLTAGE WIRES FROM THE RELAY. EASY, NO?"

EASY, YES! EVEN THE SWITCH IS COLOR CODED SO THAT MATCHING THE SWITCH LEG WIRE TO THE SWITCH TERMINALS ARE A SNAP. REMMIE, LOW-VOLTAGE WIRING THE **REMCON** WAY IS SO SIMPLE... IT DOESN'T LET YOU MAKE A MISTAKE!

AND FOR WIRING, YOU WORK WITH #18 WIRE INSTEAD OF ARMORED CABLE AND USE A MOUNTING BRACKET IN PLACE OF A SWITCH BOX

A GREAT WAY TO **CUT WORK TIME** AND **MATERIAL COSTS.**

TAKE A TIP FROM ME, FELLERS... SWITCH TO **REMCON.** YOU'LL FIND ALL THE REASONS WHY BY WRITING FOR MY **ELECTRICIAN'S MANUAL** TO...

REMCON

A DIVISION OF

PYRAMID INSTRUMENT CORP.-Dept. A4

630 MERRICK RD.

LYNBROOK, NEW YORK



WHEN YOU MODERNIZE WITH GENERAL ELECTRIC INTERLOCKED ARMOR CABLE, YOU PROVIDE

More power in half the space at half the cost

The steadily expanding use of new plant equipment has created an enormous need for more power. This need can be met, and met economically. In fact, it is now possible to get more power in half the space at half the cost. This can be achieved — without major conversion — by modernizing with a General Electric interlocked armor cable system. Here's why: (1) fewer cables carry greater loads — often more than twice as much power, compared with other types of wiring, (2) because fewer cables are needed, less space is required — often as much as 50% less, and (3) because installation is simple and easy, cost is lower — sometimes as much as 50% lower than with other conventional methods.

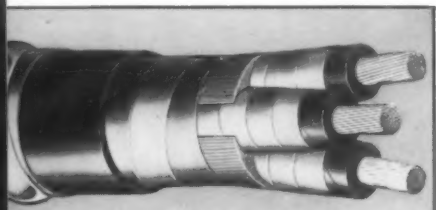
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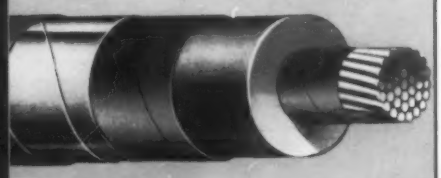
FOR MORE DETAILS, JUST TURN THE PAGE

4 General Electric cables for modernization which prove that:

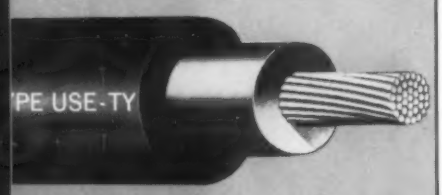
IT'S WHAT'S OVER THE CONDUCTOR THAT COUNTS



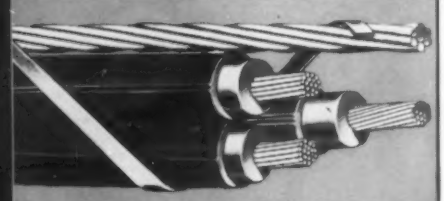
INTERLOCKED ARMOR CABLE. Modernization is easy, and fast—and the results are attractive with G-E interlocked armor cable because of advantages like these: cable can be run around corners, over beams and through or on structural members; long continuous runs are easy (there are few splices, and no pull boxes are needed); G-E interlocked armor cable weighs as much as ⅔ less than conventional cable and conduit installations. It offers a wide choice of insulations — rubber, Dacron** glass, thermoplastic, silicone rubber, or asbestos. Ratings: 600 to 15,000 volts. For complete information—for new work or modernization —send the coupon below for this bulletin on G-E interlocked armor cable.



SUPER CORONOL* FLAMENOL* CABLE—a rubber-type cable designed for power circuits for continuous operation at conductor temperatures of 90 C up to 5000 volts, and 85 C in the 5,001-15,000 volt range. Insulation has exceptional resistance to ozone, heat, moisture, and aging. For complete information send for this bulletin by using the coupon below.



VERSATOL* GEOPRENE* CABLE—an all-purpose rubber insulated cable for circuits where dependability under hard usage is required. It is suitable for practically any 600-volt power or control circuit, for 75 C operation. Most types can be installed in conduit, in the air, or directly in the ground. Versatol Geoprene cable is exceptionally resistant to the effects of age and weather. It withstands oils, soil acids and alkalis, and moisture. For full details, read this bulletin. Just use the coupon below.



AERIAL CABLE—lightweight, flexible, easily handled, spliced and terminated. Eliminates expensive first cost of underground installations, can be easily tapped because of its accessibility. For the complete story, read the new bulletin on G-E aerial cable. Use the coupon below.



* Registered Trade-mark General Electric Co.
** DuPont Registered Trade-mark.

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SEE YOUR G-E WIRE AND CABLE DISTRIBUTOR FOR COMPLETE INFORMATION, OR MAIL THIS COUPON:

General Electric Company
Wire and Cable Dept.
1285 Boston Ave.
Bridgeport 2, Conn.

Name_____ **Title**_____

Company_____

Address_____

City_____ **Zone**_____ **State**_____

PLEASE SEND ME YOUR BOOKLETS ON THE FOLLOWING:

- ☐ G-E Interlocked Armor Cable
- ☐ G-E Super Coronol Cable
- ☐ G-E Versatol Geoprene Cable
- ☐ G-E Aerial Cable

To increase your sales of outdoor lighting

The NEW Mind-O-Light®

Completely Automatic!

It turns post lights ON at dusk...OFF at dawn!

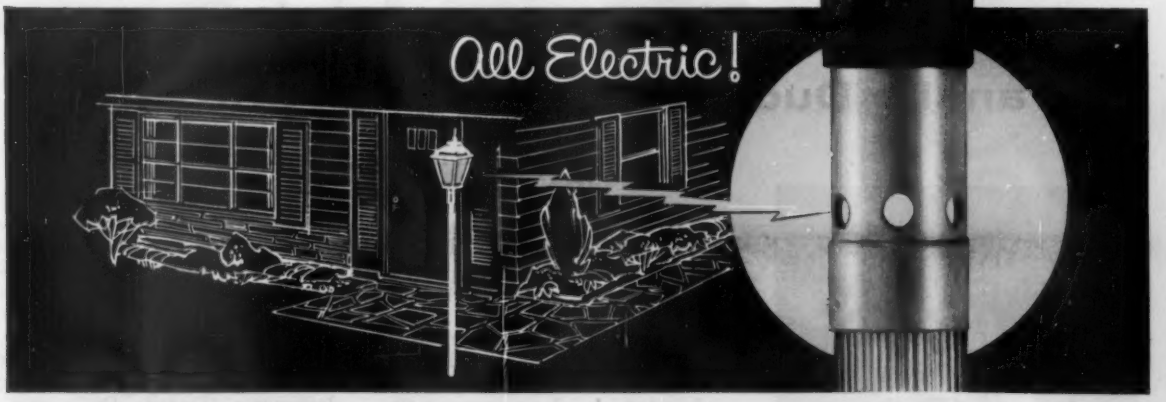
Now increase your lighting sales, sell bigger and more profitable jobs, with the new Virden Mind-O-Light. Easily installed on any new or existing standard 3" post . . . with 3" O.D. post light, the new Virden Mind-O-Light automatically turns the lights *on* at dusk. It provides illumination and protection all night long when it is needed, turns the lights *off* at dawn, when it's not. Completely electrical, it is installed by electricians. Doesn't waste current. Perfectly safe.

Quality made by Virden, from the finest materials, it is fully guaranteed for one year. 5 amp. rating. Available in aluminum or black finish, with or without convenience outlet. Requires no orientation. Over-controlled with inside switch.

Your Virden distributor has the Mind-O-Light in stock now. Or mail the coupon below for full details plus a complete showing of the new Virden post lights and posts.



Union Made
UL Approved



Another "light idea" from

virden
LIGHTING

A division of the John C. Virden Co., Cleveland, Ohio
In Canada, John C. Virden Ltd., Toronto, Ontario.
Member American Home Lighting Institute

®John C. Virden Co.

Virden Lighting, Dept. ECM
5209 Euclid Ave., Cleveland 3, Ohio

I want to know more about your Mind-O-Light. Please send me complete details. (Brochure 124)

Name_____

Address_____

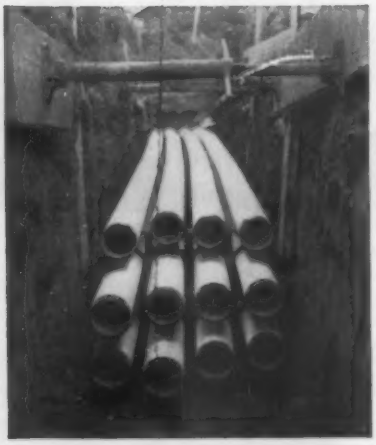
City_____ Zone____ State_____

Get peak cable protection ***at lowest dollar cost***



Transite Ducts can be laid directly in trench without concrete envelope. Or if ductbank is to be concrete enclosed—thinner walled Transite Duct may be used. In all other respects both heavy-wall and thin-wall Transite Ducts are identical.

Transite Ducts save on the job and after!



No other duct material gives you so many installation and in-service economies

In every way, Transite® Ducts are the most efficient electrical ducts you can install. And—when assembled with J-M's Plastic Coupling—their cost is remarkably low!

One reason for this economy is in installation. Strong, lightweight, long—Transite lengths are easy to handle and install . . . Your men set the ducts in place easily, join them tightly in seconds. Transite's smooth bore is free of burrs and obstructions. Thus, long cable pulls are easily accomplished with no damage to cable sheathing.

You see another reason for Transite's economy in performance. Once in service, Transite's unusually high rate of heat dissipation means cables run cooler, last longer. Transite also confines arc damage . . . cannot burn, smoke or fume. It won't generate explosive or toxic gases. If arcing does occur, Transite Ducts won't sag or adhere to cable.

Let us send the Transite Duct brochure EL-29A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JOHNS-MANVILLE JM PRODUCTS



First . . . and still the best!

13 years of continuous improvement has kept "SCOTCH" No. 33 the "number one" plastic electrical tape.

"SCOTCH" AND THE PLAID DESIGN ARE REGISTERED TRADEMARKS OF 3M CO.

MINNESOTA MINING AND MANUFACTURING COMPANY
. . . WHERE RESEARCH IS THE KEY TO TOMORROW
3M COMPANY

RECESSED TROFFERS BY **SYLVANIA**

...designed for the man who *works with lighting!*



Sylvania Troffers—ideal for modern building practices —offer specific advantages to designer and contractor.

Sylvania's new line of Recessed Troffers has received exceptional acceptance from men who know and work with lighting . . . and for good reasons.

These Troffers give the smart trim appearance and good lighting qualities that guarantee user satisfaction. In addition, they have important *built-in features* which are not apparent to this user—but *which are vital to the designer and contractor responsible for the specification and installation of the lighting equipment.*

FOR THE DESIGNER—Shallow Sylvania Troffers combine smooth, uncluttered finished appearance with practically limitless application possibilities.

The use of hidden latches and hinges and the extensive choice of shielding media bring the designer's ideas to attractive reality in the finished installation.

3 types of fixture housing—with exposed, concealed or fit-in flanges—permit Sylvania Troffers to fit ALL popular ceilings.

And Sylvania Troffers achieve any desired lighting layout because of the wide choice of standard elements including 1′ and 2′ wide models, downlighting Accent Units and 4′ x 4′ units.

FOR THE ELECTRICAL CONTRACTOR

Sylvania Troffers supply labor saving, time saving advantages so necessary for profitable operation. For instance—Sylvania's exclusive Snap-Up Hanger eliminates the need of hanger straps for many ceiling types and reduces installation time appreciably . . . and the adjusting screw of this Snap-Up Hanger levels the Troffer simply and quickly through the use of a screwdriver from below.

Wasted time and motion on the job are eliminated through Sylvania's use of maximum factory pre-assembly and unit packing. Fixtures are normally shipped in individual cartons with end caps and accessories in place and with shield frame and shielding installed.

The next time you specify or install recessed lighting, check the many advantages of Sylvania Troffers before making your choice. Compare Sylvania Troffers feature for feature with other makes. Then you be the judge.

For complete information, write to:

SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
Department S-59-10
One 48th Street, Wheeling, West Virginia

GO MODERN WITH LIGHTING BY **SYLVANIA**

Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

FLUORESCENT LIGHTING FIXTURES AND SYSTEMS • BEST FIXTURE VALUE IN EVERY PRICE RANGE

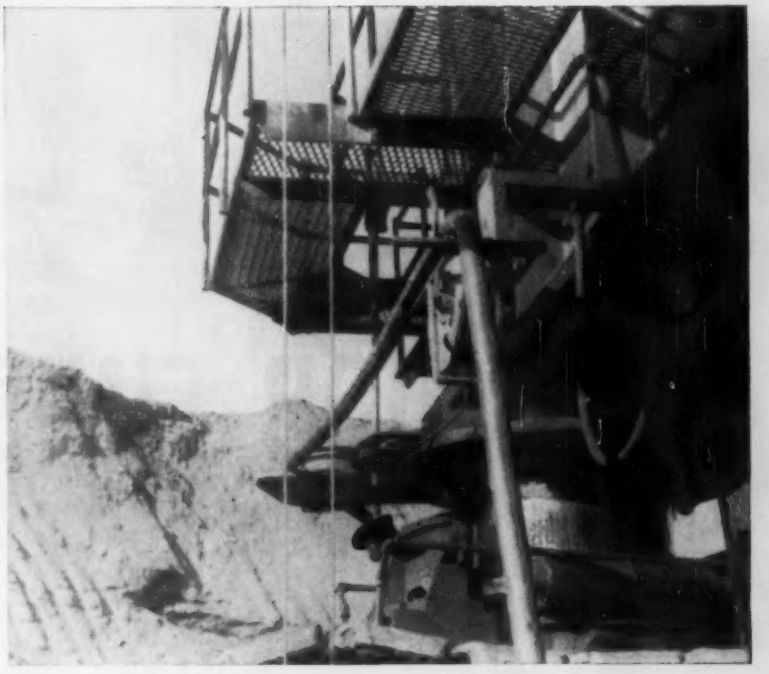
The Importance of Balanced Compounding in Portable Cable Design

A portable cable is constantly under attack from many different directions. It is dragged over rough floor surfaces and rocky terrain, crushed under the wheels of trucks and carts, continually bent, flexed and stretched. In addition, it is very often subjected to attack by water, solvents, oil and ozone.

To give long, dependable service, portable cables must be able to withstand rough treatment, and must have built-in protection against all deteriorating factors. Moreover, they must possess other desirable qualities such as lightness and flexibility.

The science in designing these cables is to add the necessary ingredients in the jacket to provide maximum protection along with the maximum of other desirable features. This is where *Balanced Compounding* comes in. It is very easy to provide protection against one or two of the deteriorating factors, simply by loading the compound with an ingredient which is impervious or highly resistant to these factors. Unfortunately, however, the ingredients which provide resistance to abrasion or crushing may be highly susceptible to attack by oil or water; and vice versa.

The cable designer's problem, then, is to attain a balance in his compounding formula which will provide maximum protection against one deteriorating factor without reducing protection against others below the danger point.



To the buyer of cables, this means that *quantity* of any one ingredient is unimportant, unless it is considered in relation to the over-all ability of the cable jacket to resist *all* of the abuses to which it is subjected.

For balanced resistance to all these abuses, the best assurance you can get lies in the quality of the research and development facilities of the manufacturer, and the product's record of performance.

This is one reason why — in those industries where portable cables are continually used or purchased as components of a manufactured product — Simplex Tirex Cables are regarded as the standard.

Proof of the worth of Tirex *Balanced Compounding*, which gives balanced resistance to all the deteriorating factors of normal use, can be found in the fact that Tirex cables have been successfully performing under the most rugged operating conditions for periods ranging up to twenty years.

BALANCED COMPOUNDING CURED IN LEAD

Simplex

WIRE & CABLE COMPANY

Cambridge, Massachusetts and
Newington, New Hampshire



with General Electric's NEW Integral Distribution Center

An electrician can install General Electric's new Integral Distribution Center in only four hours—faster and easier than other types.

This remarkable savings in time is made possible by:

ONE-PIECE CONSTRUCTION—Unit ships in one piece; eliminates need for assembling separate components at point of installation.

SMALL SIZE—Low height (only 79 inches) and up to three feet shorter in length allow new G-E Integral Distribution Centers to be moved through normal-size doors by means of a fork truck. Unit weighs up to 23 percent less than old designs and can be rolled or skidded in any direction for easy positioning.

EASY TO CONNECT—All lines can be brought in through either top or bottom, and all connections can be made from the front of the unit. All units are furnished with solderless connectors for incoming and outgoing lines.

Why not use the distribution center that gives you "balanced design"? It installs and connects easier, faster. And gives your customers an *ideal balance* of quiet operation (G-E QHT* transformers are up to 16 decibels below NEMA sound standards); compact, space-saving design (units require up to 30 percent less floor space); and safe, reliable operation (Type H insulation in units up to 5000 volts; Class B insulation in units above 5000).

WANT MORE INFORMATION? Fill in the coupon at right or contact your nearby General Electric Apparatus Distributor.

* Quiet High-Temperature dry-type transformers.

Be sure to see G.E.'s new ID Center at the NECA Show, Booths 38-47.

One-piece construction simplifies ordering, installation and connection

ELECTRICIAN Don Shoner found G.E.'s new Integral Distribution Center simple, fast to connect, using only the tools normally found in any electrician's work cart. Don completed installation of the 225-kva, 240-volt unit in only four hours.



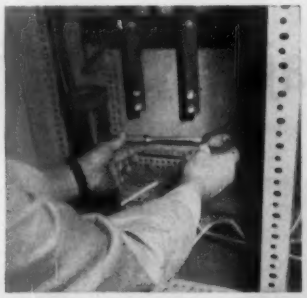
9:01 A.M.—Unit in place and front panels being removed. High- and low-voltage compartments are immediately accessible on the new G-E unit.



9:31 A.M.—Outgoing leads are connected to breaker panel. Quick-connect terminals require no soldering or taping.



10:31 A.M.—Fuses and fuse panel are removed in minutes allowing the electrician quick, easy access to the incoming connectors.



10:45 A.M.—Incoming lines are easily connected; do not require taping or soldering. Fuses and fuse panel are replaced easily.



11:15 A.M.—Transformer taps are changed to match incoming voltage. And then the panels are replaced.

GENERAL ELECTRIC



SEND FOR THIS BULLETIN giving the full story on G-E Integral Distribution Centers.

SECTION B411-10
General Electric Co.
Schenectady 5, N. Y.

Please send me GEA-6928, "General Electric New Type H Integral Distribution Centers."

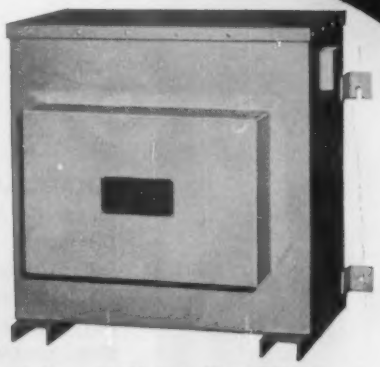
NAME _____
TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ **ZONE** _____ **STATE** _____

Uptegraff redesigns



1.

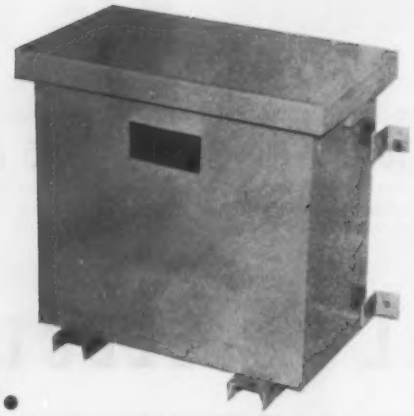
3 kva—10 kva (Type H) Class H Insulation, Totally-enclosed, Underwriters' approved



2.

15 kva—112½ kva (Type DH & DHT) Class H Insulation, Totally-enclosed

4 major types—modern design features



3.

3 kva—112½ kva (Type DB & DBT) Class B Insulation, High and Low Voltage Separation



4.

150 kva—500 kva (Type DX & DXT) Class B Insulation, Ventilated

R. E. UPTEGRAFF MANUFACTURING CO.

SCOTTDALE, PENNSYLVANIA

dry type transformer line

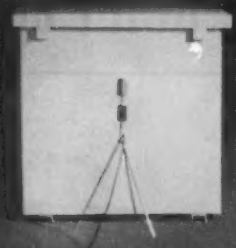
New Compactness

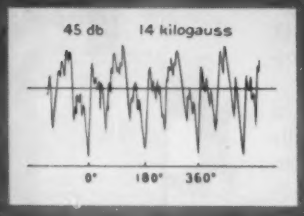
Lighter Weight

Easy to Install

Quieter Sound Level

Greater Overload Capacity



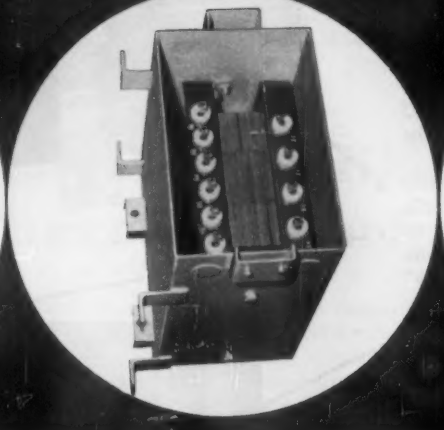




To achieve quieter transformer operation, Uptegraff applied intensive acoustical redesign to its Dry Type Distribution Transformer line. Subsequent sound level testing, as seen here, gives added assurance of quiet transformer operation.



Types DH and DHT feature accessibility of terminals and taps housed in separate external junction box, and flexibility in mounting and conduit entrance.



Terminal boards on the type DB and DBT transformers are exclusively porcelain and steel, assuring safe, long operating life. Liberal design permits easy accessibility.



This compact, wall-mounted type H unit was redesigned for easy accessibility to its convenient clamp-type terminals.

This Bulletin

gives complete specifications of Uptegraff's 4 major Dry Type Transformers, ranging from 3 kva to 500 kva, 4800 volts and less. It includes dimensions, weights, cable connector sizes, voltage ratings, taps, and maximum noise level.



Mail coupon today, for your personal copy

R. E. UPTEGRAFF MANUFACTURING COMPANY
Scottdale, Pennsylvania

Gentlemen: Please send me a copy of Bulletin 137-A on Dry Type Distribution Transformers.

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

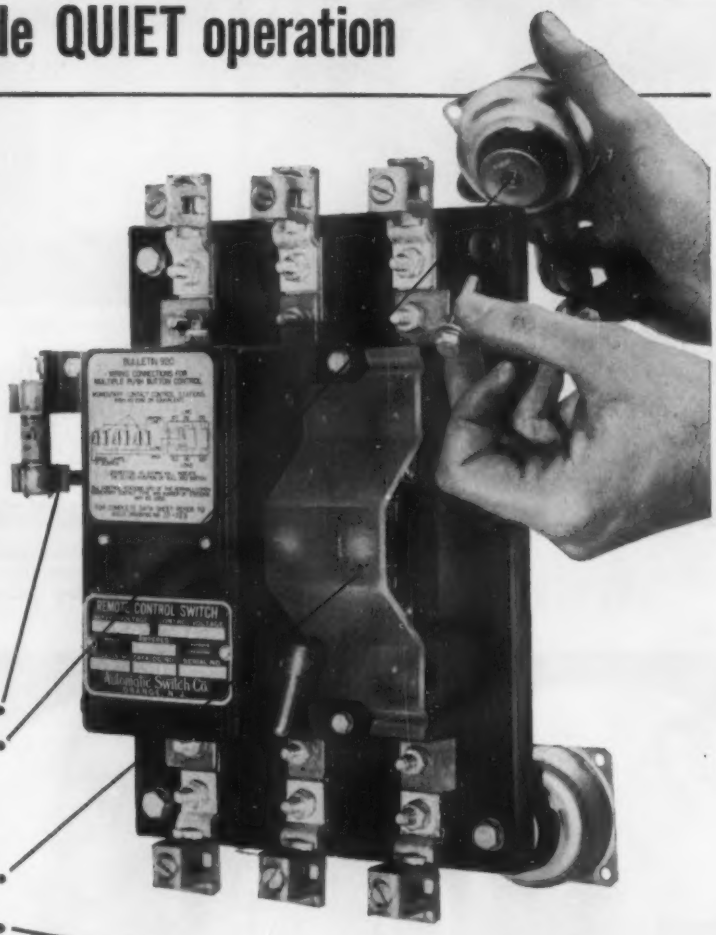
ASCO Remote Control Switches with vibration mounts and soundproof enclosures provide QUIET operation

ASCO Mechanically Held Remote Control Switches have always been inherently quiet in open or closed position. The coil is energized only during the instant of operation; accordingly, the Switch is free from distracting A-C hum.

Now, through ASCO accessories, shock noises produced during opening and closing can be drastically reduced.

Shock and Vibration Isolators are easy to install—reduce operating noise normally audible from 250 ft. away to unobjectionable levels at 35 ft.

Soundproof Enclosures, when added to the shock and vibration isolators, reduce the sound of switch operation to a click faintly audible from a distance of only 3 feet.



COMPLETE ACCESSORIES

Rugged, simple Bulletin 920 Remote Control Switches are available with:

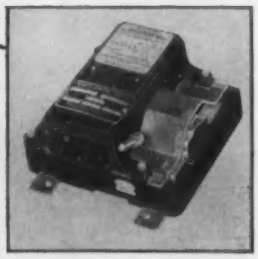
Adapter–for control line fuse.

Shock and Vibration Isolator Mounts – provide efficient shock absorption, substantially reduce switch operating noise. Mounts are easily installed or removed –a single bolt holds each one to the panel.

Cover Plate – permits manual operation with complete protection from contacts.

Reduced Width Dimensions – for installations where space is at a premium. Reduced width 920 RC is only 5⅞" wide!

Soundproof Enclosure – with bonded acoustical insulation. Since ASCO switches are designed to operate in unventilated enclosures, derating is never necessary.





ASCO Bulletin 920 Switches equipped with low voltage control are suitable for 24-volt A-C control by push button, time switches, relays or other control methods—installation costs go down, safety and permissible line runs are increased.

For complete data on ASCO Remote Control Switches and accessories, write for Catalog 57-S2.

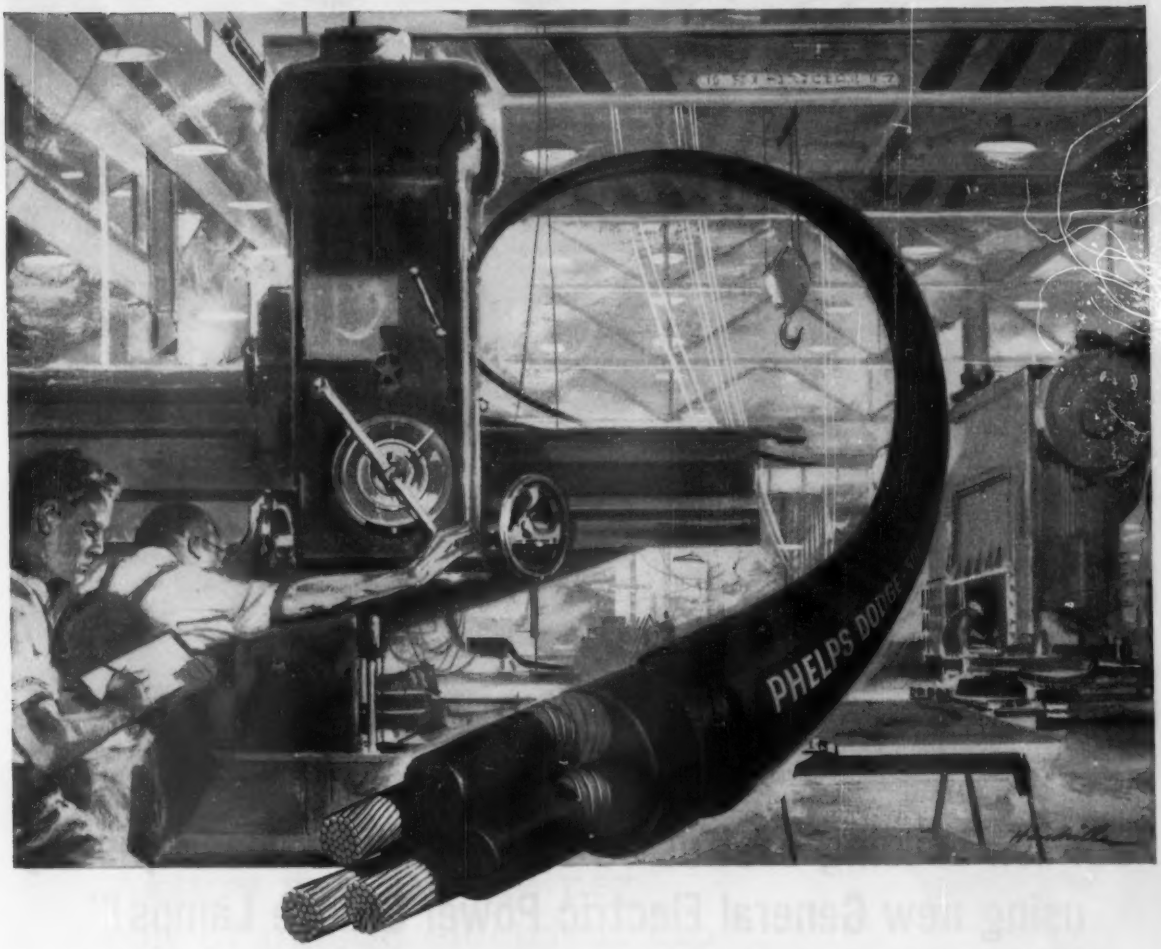
Automatic Switch Co.

50J Hanover Road, Florham Park, New Jersey • FRontier 7-4600

AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

ASCO®

Steady plant production demands dependable power cable . . .



HABIRITE-HABIRPRENE CABLE gives unexcelled performance!

To help assure uninterrupted production, modern industrial plants require reliable cables for delivering electric power to production lines. The service reliability of Phelps Dodge *Habirite-Habirprene* is unsurpassed by any other rubber insulated neoprene jacketed type RR cable.

Habirite-Habirprene is a combination of specially engineered butyl rubber insulation and neoprene jacket. The overall features of this cable provide greater resistance to heat, oxidation and ozone; improved electrical properties, including superior insulation resistance; higher copper operating temperature; superior flexibility; improved mechanical toughness against damage from installation hazards and extra resistance to corona, an absolute necessity for high-voltage neoprene jacketed cable.

As a general purpose cable, *Habirite-Habirprene* assures the utmost in safety, durability and reliability.

See Your Phelps Dodge Distributor!

PHELPS DODGE COPPER PRODUCTS CORPORATION

PD

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N.C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D.C.



NO SUPPLEMENTARY LIGHTING—Here inside the new wing of Assembly Products, Inc., the Power Groove general lighting does all the work—without supplementary lighting—improving appearance and efficiency, reducing initial cost and operating expense.

"Our new building cost us 50¢ a square foot less—just by using new General Electric Power Groove Lamps!"

says Mr. John D. Saint-Amour, President, Assembly Products, Inc., Chesterland, Ohio

When Assembly Products, Inc., an aggressive and growing manufacturer of meter-relays, added a new wing to its plant in Chesterland, Ohio, it quickly settled on new General Electric Power Groove Lamps. Why Power Grooves? Because they got more light per lamp—so they needed fewer lamps and fixtures. They got a comfortable 250-footcandles on the work, *and saved 50¢ a square foot over the next most powerful fluorescent lamp type.*

In a recent letter to General Electric, Mr. John D. Saint-Amour, president of Assembly Products, said: "The Power Groove system recently installed in the new wing of our plant has already proved to be a valuable investment. In the older plant area, both general lighting and supplementary lighting were required. The general lighting *alone* is all that's needed in our new wing. We're confident this new lighting system will result in better, faster, and more efficient production."

PLANNING NEW LIGHTING? Then find out all about the *new* G-E Power Groove Lamps. They come in 4, 6 and 8-foot lengths—designed to deliver up to 15,000 lumens, and they're interchangeable with original Power Grooves. For more information, write: General Electric Co., Large Lamp Dept. C-938, Nela Park, Cleveland 12, Ohio.

SAVINGS ON INITIAL INVESTMENT BY USING G-E POWER GROOVES COMPARED TO OTHER 8-FOOT FLUORESCENTS

(Based on a 250-footcandle level, at about $2.06 per square foot using Power Grooves)	SAVINGS PER FOOT	SAVINGS PER 10,000 FT.
POWER GROOVES vs. 8′ HIGH OUTPUT LAMPS (at $2.56/sq.ft.)	50¢	$5,000
POWER GROOVES vs. 8′ SLIMLINE LAMPS (at $2.83/sq.ft.)	77¢	$7,700

Progress Is Our Most Important Product

GENERAL ELECTRIC



Assure more usage per roll of plastic electrical tape

Ask for J-M DUTCH BRAND

contractor's size roll.

Contractors find they save money with Dutch Brand's convenient packaging and complete line of tapes. For example, our contractor's-size roll of plastic electrical tape is a full 44 feet in length. This special size—exclusive with Dutch Brand—allows far greater economy in allocating materials to a job. Waste is cut to an absolute minimum for this is the length studies show a workman uses on an average job. Here's a worthwhile saving when you figure tape wastage per man and multiply it by the number of men in your crew. Yet, this 44-ft. roll costs you *no more* per foot than larger rolls.

Dutch Brand Plastic Electrical Tapes are available in 44-ft. and 66-ft. rolls. They're thin, strong, flexible—offer unusual resistance to acids, alkalies, oil, solvents, fungus, bacteria, gases. Made to meet the highest industry standards. Ask your supplier for Dutch Brand now. *Johns-Manville Dutch Brand Products, 7800 South Woodlawn Avenue, Chicago 19, Illinois.*

WRITE FOR NEW BOOKLET!

Looking for new ideas on tape as a time-and-money-saver? Ask for "Big Four in Electrical Tapes." Do it today!





JOHNS-MANVILLE

JOHNS MANVILLE JM PRODUCTS

SPECIAL REPORT ON

PTC TRANSFORMERS

Showing WHY Electrical Engineers, Consulting Engineers and Contractors should Seriously Consider Specifying and/or Installing them on ANY Job.

THE INSIDE STORY

EVERY PRECISION TRANSFORMER IN THE ENTIRE LINE OFFERS THESE BASIC CONSTRUCTION ADVANTAGES:

1. SPECIAL CORES—Manufactured from high grade, non-aging grain oriented, silicon steel laminations . . . with lowest energy loss of any steel available.

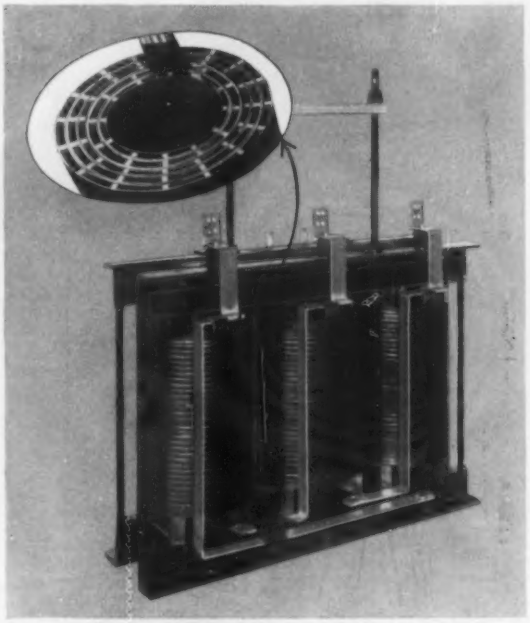
2. EFFECTIVE COOLING DUCTS—More efficient cooling through use of larger, exposed cooling ducts . . . Results in lower operating temperatures.

3. RIGID CORE CLAMPING—Core laminations are clamped together with structural steel; not formed sheet steel.

4. GLASS LAMINATE SPACERS—Tougher, more rigid duct spacers of glass laminate possess dimensional stability and moisture resistance many times greater than wood and paper phenolic.

5. MORE SECURE COIL BRACING— To resist short circuit forces and transportation hazards.

6. SUPERIOR MATERIALS—Insulating varnishes and enamels are selected for highest quality. Coils are made with an interlayer and interwinding insulation of Mylar-Quinterra and glass.



7. BETTER MOUNTING PROVISIONS—Well designed . . . easily accessible mountings . . . ample connecting space and simple wiring terminations.

PERFORMANCE RESULTS

BECAUSE PTC TRANSFORMERS ARE QUALITY BUILT, THEY CONSISTENTLY AFFORD THESE QUALITY RESULTS

1. EXTREME QUIETNESS—

KVA Transformer Rating	Present NEMA	Precision Average Sound Level Standard Design	Special Design
9—30	50	40	34
37½—112½	55	42	38
125—167	60	44	42
200—300	62	48	46

2. EFFICIENCY— Precision Transformers have the lowest operating loss of any transformer.

3. TOP OVERLOAD CAPACITY— Operate at lower temperatures at normal load . . . and capable of withstanding increased temperatures due to overload . . . with NO LOSS OF LIFE.

4. RELIABILITY . . . LONG LIFE—Fully meet all the VARYING CONDITIONS under which they must be used . . . stand up under the most severe usage.

5. LOWER INSTALLATION COSTS—All PTC Transformers provide neater installations at lower cost.

6. TOTAL WARRANTY— Unconditionally guaranteed by Precision Transformer Corp. for 5 years.

COMPLETE LINE

Whatever your transformer needs, there is a dependable, quiet, long-lasting PTC dry or liquid type transformer—more than 4,000 models ranging from ¼ to 5,000 KVA.

Included is the whisper-quiet, inside-the-wall "HUSH-FLUSH" design for schools, libraries, hospitals, churches, theatres, etc.

Write today for 4-page brochure providing details on the PTC line.

PTC TRANSFORMERS
• QUIET
• EFFICIENT
• DEPENDABLE

PRECISION TRANSFORMER CORP.
2211 West Lake Street • Chicago 12, Illinois
Representatives in all principal cities



Balance . . .

what does it mean in cable?

No one characteristic alone determines good cable. It's the right balance of many qualities that counts. Carol *has* this balance. Look at these significant test results.

	BRAND			
	CAROL	A	B	C
Electrical Insulation Resistance (1)	100	17	16	68
Cold Bend °F (2)	−50	−45	−90	−50
Abrasion Resistance (1)	91	62	100	92
Ozone Resistance (1)	100	6	18	12

Note: (1) 100 indicates best—others % of best (2) cold bend—actual test temperature

As can be seen, needlessly high cold flexibility can be built into cable . . . but only at the sacrifice of more important electrical properties. And in Brands A, B and C you will also note the lack of balance between abrasion resistance and ozone resistance . . . which means these cables can crack long before they wear out.

Carol, on the other hand, has not only the highest *combined* rating but is also the best *balanced*. As a result of years of experience and research, primary emphasis has been placed on the characteristics most vital in cable life and performance.

To you, this means superior quality *throughout* . . . *extra* quality and performance where it is most needed.

when you call for cable— call for

Carol®

PORTABLE CORDS • POWER SUPPLY CABLE • CONTROL CABLES • WELDING CABLE • GOVERNMENT TYPES • CORD SETS

Only Sylvania VHO POWERTUBES*

give you all of these Very High Intensity lamp advantages!



1. More than twice as much light as obtainable from standard fluorescent lamps of same size.



3. Easier to handle than competitive high intensity lamps . . . Sylvania VHO POWERTUBES weigh half as much as other shapes.

2. Smooth surface—the preferred tubular shape that does not catch and hold dust.

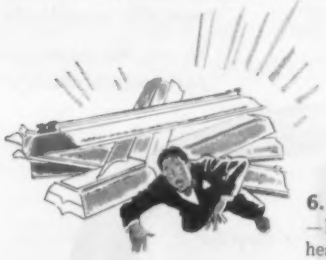


4. Smaller in size—T-12 1½" tube diameter permits better air circulation around the tube than larger diameter lamps.



5. Lower in cost—less expensive to buy and install, provide more lumens. The 8-foot, 200-watt VHO POWERTUBE, for example, delivers 15,000 lumens! Easier to stay clean, quicker to wipe clean than special shape lamps.





7. Uniform light distribution delivers full light output in any position.



6. Does not require "oversized" fixtures—helps keep fixtures costs down, avoids heavy tube strain on fixtures.

8. Better optical control permits full use of light directed exactly where *you* want it.





And only Sylvania Fluorescent Lamps are backed by the exclusive Sylvania Light Insurance Policy!

Guaranteed by Sylvania, the Policy specifies if, in your opinion, Sylvania's lamps do not perform better than the brand you are now using, you may return them to our distributor and get your money back.

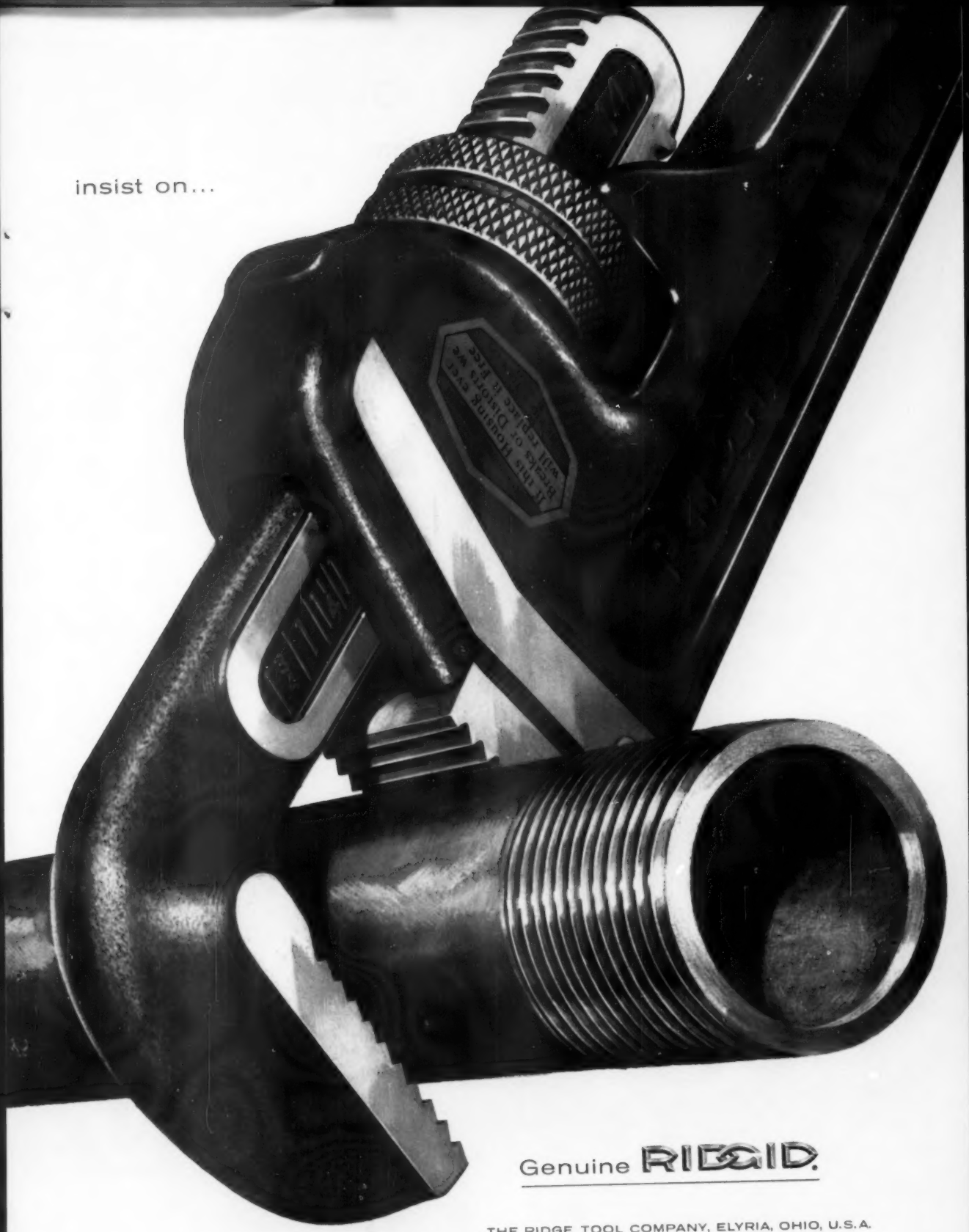
*Trademark

Ask your Sylvania representative or supplier to see a copy of the revolutionary Sylvania Light Insurance Policy. Or write:

SYLVANIA LIGHTING PRODUCTS
Dept. 9L-8310, 60 Boston Street,
Salem, Massachusetts
In Canada: Sylvania Electric (Canada) Ltd.
P. O. Box 1190, Station "O", Montreal 9

SYLVANIA
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

insist on...



Genuine RIDGID.

THE RIDGE TOOL COMPANY, ELYRIA, OHIO, U.S.A.



Porter® VINYL TAPE

Unqualified approval by Westinghouse Refrigeration Division!

Porter Vinyl Tape has been tested to meet the tough Westinghouse specification for use in new refrigerator-freezer combinations, and has received unqualified approval on every point.

Westinghouse rated tapes on the following points: Breaking strength • Adhesion • Low- and high-temperature properties • Staining • Moisture-resistance • Elongation • Odor • Dielectric strength • Effect on polystyrene—and Porter met the spec's on every count!

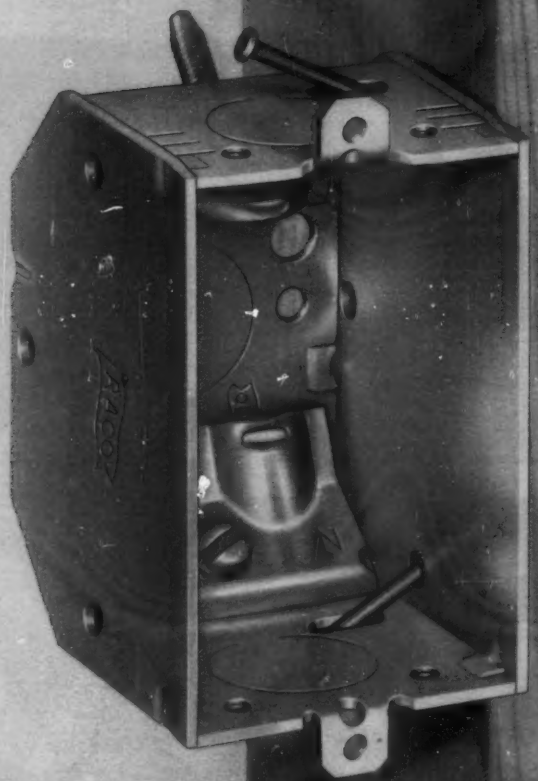
Special new winding and slitting techniques keep Porter Vinyl Tape from telescoping on the roll, and help save space in tight spots where compact winding is essential. Another feature is its self-extinguishing property—it will not support combustion.

Get complete information by writing *Thermoid Division, H. K. Porter Company, Inc., Tacony & Comly Sts., Philadelphia 24, Pa.*



THERMOID DIVISION **PORTER** **H.K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD



New RACO WELDED SWITCH BOXES

...big cost savings...easier to install

New RACO welded switch boxes offer you these important advantages:

—big cost savings per box

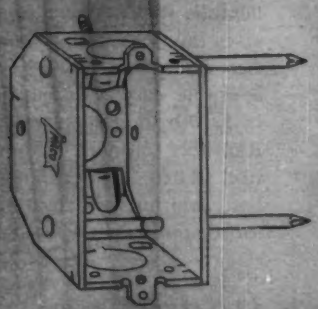
—greater strength because box is *projection welded*

—three sets of "straight-through" nail holes for faster mounting

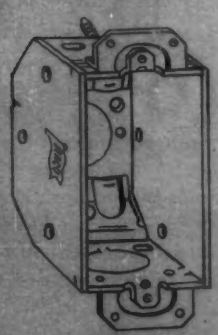
—new knockout slots at each end for easy angle-nailing in tight areas

—flat sides for quicker, smoother installation

Your RACO Distributor has the new welded non-gangable, beveled corner switch boxes with or without staked nails, with or without ears. Try them now for greater savings, easier installation.



No. 495 bevel-corner box has staked nails for faster, easier installation



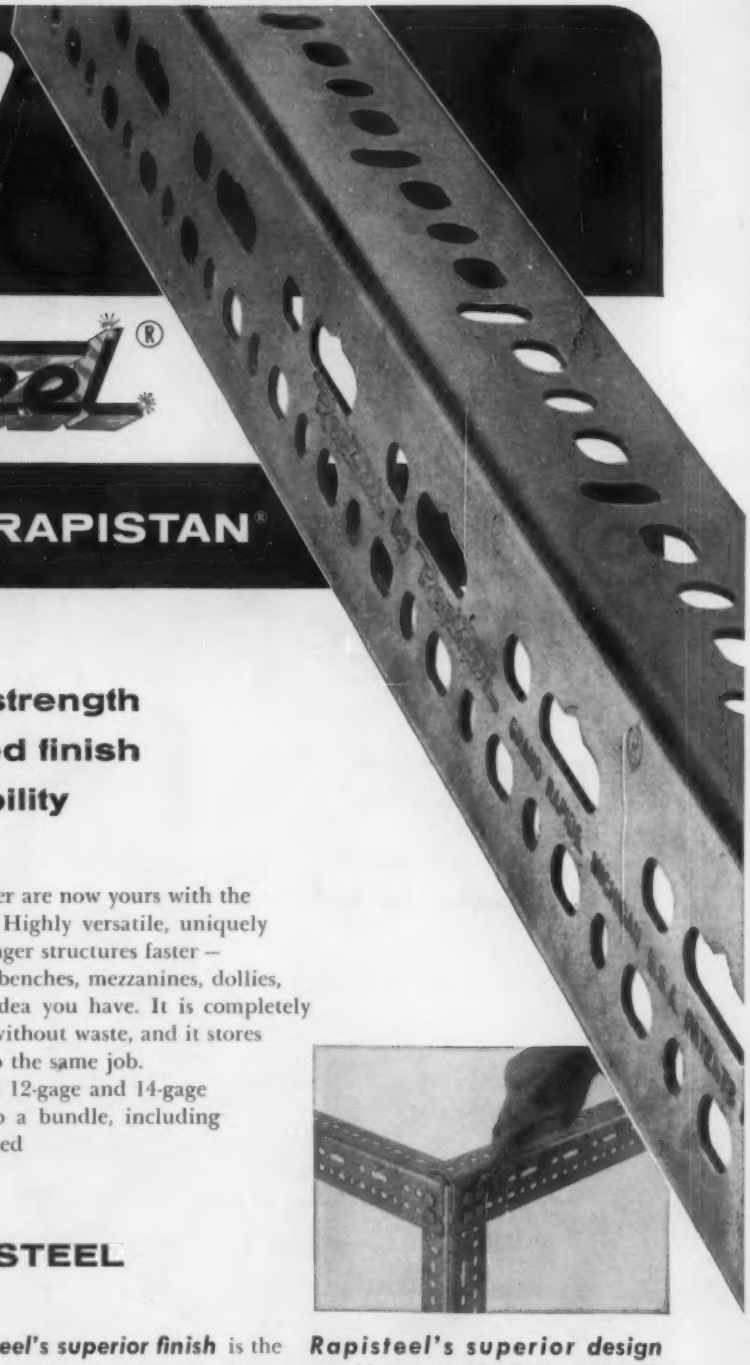
No. 482 is available with two-screw plaster ears

ALL-STEEL EQUIPMENT INC.
AURORA, ILLINOIS

NEW!

Rapisteel®

slotted angle by RAPISTAN®



gives you...

greater structural strength
superior galvanized finish
more design flexibility

New savings in time, materials and manpower are now yours with the new Rapisteel metal construction material. Highly versatile, uniquely flexible, Rapisteel lets you put together stronger structures faster — saves hours in building storage racks, work benches, mezzanines, dollies, electrical panel boards — any construction idea you have. It is completely re-usable, easy to dismantle and reassemble without waste, and it stores in 1/10th the space needed for lumber to do the same job. Rapisteel comes in 10′ and 12′ lengths, both 12-gage and 14-gage steel. There are ten lengths of Rapisteel to a bundle, including bolts and nuts which are specially heat treated for maximum shear strength.

USERS PREFER RAPISTEEL

Rapisteel's superior strength gives you greater load-carrying capacity, because Rapisteel is made of prime high tensile cold rolled steel, with an improved pattern of round and slotted holes. Round holes on 1½″ centers double the usual number of positive unions in your structure, permit use of more positive support diagonal braces bolted round hole to round hole.

Rapisteel's superior finish is the famous TI-CO hot-dipped galvanized finish, giving cleanliness and lifetime resistance to corrosion, chipping and flaking. This modern method of coating features cold rolled steel, impregnated with zinc, and is recognized widely as the greatest advancement in zinc-coated steel protection.

Rapisteel's superior design provides greater flexibility in building any size and shape structure you desire, without need of special engineering tools, or the help of a factory expert. Both stationary and portable equipment can be designed and built easily without welding or drilling. Pre-measured marks on 3″ centers speed measuring and cutting.

Name your construction need... you'll build it easier with RAPISTEEL



1. HEAVY-DUTY STORAGE RACKS — This rack demonstrates the tremendous load-carrying capacity of Rapisteel structures. There's practically no limit to the size your racks can be.

2. SMALL PARTS RACKS — Rapisteel racks for storing small parts give you the utmost in flexibility. This user makes discarded containers serve as selection bins for greater economy.

3. CEILING-MOUNTED PLATFORMS — Rapisteel storage mezzanines, overhead safety guards, and other ceiling-mounted structures are rugged, easy to install and give you unequalled design flexibility.

4. ELECTRICAL PANEL BOARDS — Rapisteel builds electrical panel racks offering maximum flexibility for positioning fuse boxes, control and circuit boxes.

5. PERMANENT AND PORTABLE WORK STANDS — With Rapisteel, you can build any size and shape of work table, machine stand, cart or dolly.

Where to buy RAPISTEEL

Rapisteel is sold in principal cities by leading industrial and mill supply houses, electrical wholesalers and materials handling distributors.

ALABAMA Birmingham, Young & Vann Supply

CALIFORNIA Los Angeles, M. E. Canfield Co.
Sacramento, Capital Rubber Products
San Francisco, Rapistan of California, Inc,
San Diego, Winn Supply Co.

CONNECTICUT Hartford, Johnston & Associates

FLORIDA Jacksonville, R. B. Curlin & Sons, Inc.
Miami, R. B. Curlin & Son, Inc.
Orlando, R. B. Curlin & Son, Inc.
Tampa, R. B. Curlin & Son, Inc.

ILLINOIS Aurora, Electric Supply Corp.
Champaign, Black & Co.
Chicago, Electric Supply Corp.
Danville, Danville Industrial Supply Co.
Decatur, Black & Co.
Elgin, Fox Electric Supply Co.
Kankakee, Kankakee Industrial Supply Co.
Peoria, Couch Heyle Co.
Rock Island, Plant Equipment Co.
Springfield, Black & Co.

INDIANA Fort Wayne, Oren-Van Aman Co., Inc.
Hammond, Electric Supply Corp.
Indianapolis, Indianapolis Belting & Sup. Co.
Richmond, Queen City Supply Co.

MASSACHUSETTS Cambridge, Lewis E. Tracy Co.
Holyoke, J. Russell & Co., Inc.
Worcester, Coghlin Electric Co.

MICHIGAN Detroit, Abrasives & Supply Co.
Gullberg Industrial Equipment Co.
Madison Electric Co.
Flint, Shively Bros., Inc.
Jackson, U & I Supply Co.
Grand Rapids, G. R. Supply Co.
Kalamazoo, Kalamazoo Mill Supply
Lansing, Mill Supplies Corp.
Muskegon, Factory Supply Co.
Port Huron, Beard-Campbell Co.

NEW JERSEY Mountainside, Rapistan of New Jersey, Inc.

NEW YORK Long Island, Global Equipment Co.
New York, Topping Bros.

NO. CAROLINA Charlotte, W. W. Williams Co.
Greensboro, W. W. Williams Co.

OHIO Cincinnati, Queen City Supply Co.
Cleveland, Milner Electric Supply
McNichols Co.
Dayton, Flack Equipment
Elyria, Royal Supply Co.
Toledo, Huss Equipment Co.
Mansfield, Hartman-Spreng Co.

OREGON Portland, Air-Mac Inc. of Oregon

PENNSYLVANIA Philadelphia, Casarave Supply Co., Inc.
Pittsburgh, Banbury Equipment Corp.

RHODE ISLAND Johnston, Barker-Chadsey

SO. CAROLINA Columbia, W. W. Williams Co.

TEXAS Dallas, Baker Industrial Trucks
Houston, Rapistan-Houston, Inc.

WEST VIRGINIA Charleston, Jefferds & Moore, Inc.

WISCONSIN Milwaukee, Electric Supply Corp.
Milwaukee, Rasmussen Industrial Supply Co.

WASHINGTON Seattle, Air-Mac, Inc. of Washington
Spokane, Air-Mac, Inc. of Washington
Tacoma, Air-Mac, Inc. of Washington
Yakima, Air-Mac, Inc. of Washington

Write for new RAPISTEEL construction idea manuals



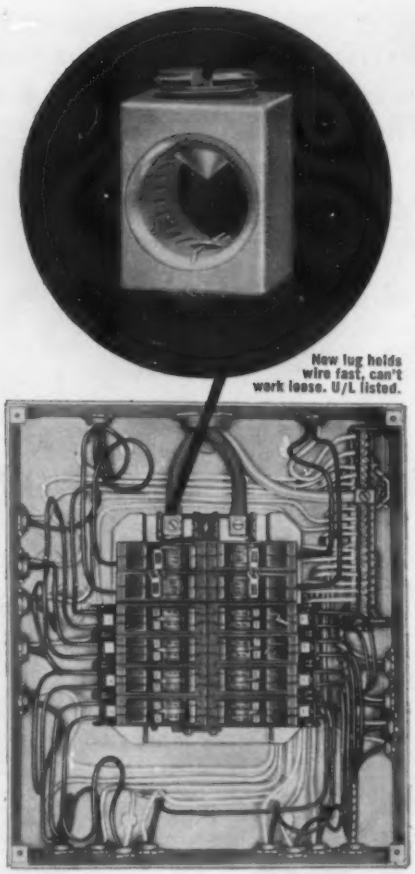
These idea books and construction guide books give you all the information needed to plan countless useful maintenance projects in which Rapisteel can cut your costs of materials and construction. For new Rapisteel Manuals write to:

The RAPIDS-STANDARD CO., Inc.
Dealer Products Division
710 Rapistan Building
Grand Rapids 2, Michigan

Rapistan®
SLOTTED ANGLE

U/L LISTED

NEW! LUGS FOR BOTH COPPER AND ALUMINUM WIRE

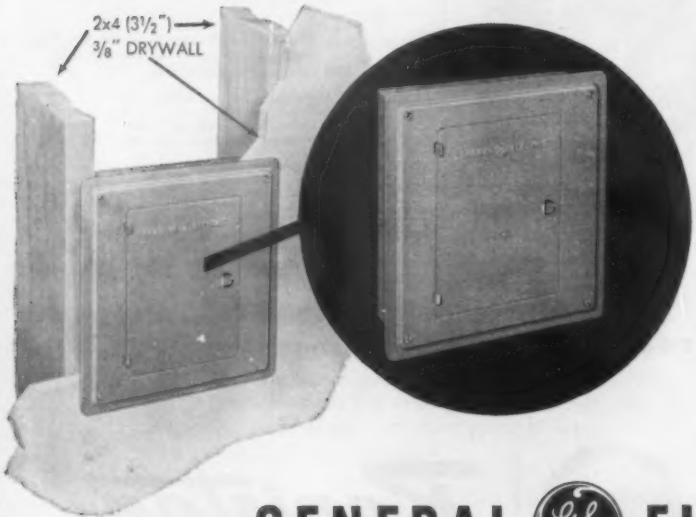


All General Electric load centers (100† and 200 amp.) and fuse pullers (100 amp.) are now U/L listed for both copper and aluminum wire—thanks to the new lug shown above which is standard on these devices *at no extra cost.*

Add this feature to the many advantages of G.E.'s new "twin" breakers and you'll see why more and more contractors are switching to General Electric for highest quality at the lowest cost. The "twin"* lets you put two quality breakers in the space you usually take for one, use a smaller load center, and realize big savings on every job.

† Except TRM Series *Trade-Mark

New G-E flush-front load centers fit flush even with 3/8" drywall



Here is a complete new line of flush-mounted General Electric "twin" load centers to answer your demands for equipment which fits flush with 2" x 4" studs and ⅜" drywall construction.

Ask your G-E distributor to show you the new *flush-front* load centers. Like all General Electric load centers, they feature Snap-Out interiors and provide automatic front alignment—even if the box is installed slightly off plumb.

GENERAL ELECTRIC

Circuit Protective Devices Dept., Plainville, Conn.

Bull Dog®
Tape



Sticks tight quick . . .
Stays tight longer!

BULL DOG sticks tight with split-second speed, yet protects circuits for years. It has the high dielectric strength you want. Resists aging, temperature extremes, moisture, dryness . . . other severe environmental conditions.

Get the tape that's proved itself on more jobs — longer than any other tape on the market. Get BULL DOG.

MAKE BULL DOG YOUR PET TAPE... *for every purpose*

- **FRICTION**
- **RUBBER**
- **PLASTIC**



Sold only through verified wholesalers

BOSTON

BOSTON WOVEN HOSE & RUBBER COMPANY
DIV. OF AMERICAN BILTRITE RUBBER CO., INC.
BOSTON 3, MASS.

Also manufacturers of Garden Hose Matting · Stair Treads · Automotive Hose



I-T-E Model ETI circuit breakers... specially designed for motor control centers

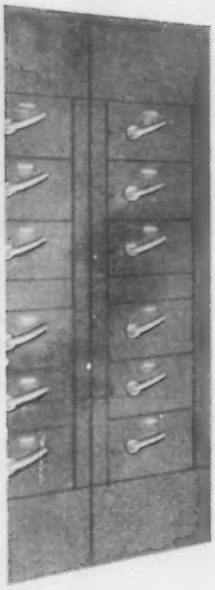
GET THE EXTRA ADVANTAGES OF THESE OTHER



Most advanced 600 v power switchgear . . . with new I-T-E K-LINE circuit breakers. Pulldown handle and stored energy mechanism give 5-cycle closure every time. Means longer contact life, greater operator safety, less maintenance. Wide load range trip adjustment saves later modification. Closed door disconnect for safety.



Best coordinated secondary unit substations. Only I-T-E designs and builds complete secondary unit substations in one plant. Engineers work closely together. So you benefit from extra time and money-saving features: better coordinated designs, easier assembly, pretested performance, and delivery to match your own construction schedule.



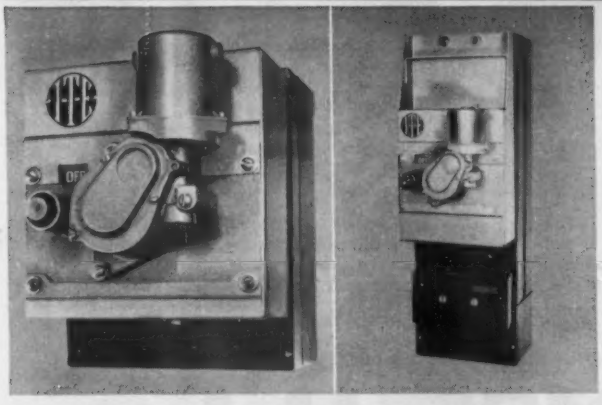
Motor circuits need this PINPOINT PROTECTION

I-T-E Model ETI circuit breakers are special purpose . . . with advantages that motor circuits need for complete protection. Unlike regular circuit breakers, they can be easily set to an instantaneous rating about 11 times normal full load current. This gives instant protection against overload damage without nuisance tripping. Regular breakers are preset at instantaneous ratings as high as 100 times full load current.

Look what this difference means. Take the example of a 20 amp breaker recommended for use with a motor starter for a 500 horsepower 440 volt a-c motor. Full load current is 7.5 amp. An ordinary breaker would have an instantaneous trip setting of 500 amp—many times the desired value. A high resistance fault or short circuit current less than 500 amp could do permanent damage before thermal devices would trip the breaker. But a 25 amp Model ETI breaker in this application would have an instantaneous trip setting of only 87 amp . . . giving instant opening in case of high current faults without nuisance tripping. Model ETI circuit breakers are available in five frame sizes and in ratings up to 800 amp continuous.

I-T-E CIRCUIT BREAKER COMPANY

I-T-E PRODUCTS TOO



TELEMAND* . . . Molded case economy . . . remote control luxury. Now I-T-E molded case circuit breakers are available with new motor operators for remote opening, closing or resetting. Can be easily wired for pushbutton control from a distance. Costs far less than alternative devices. Also permits local or automatic operation.

I-T-E Circuit Breaker Company I-4
1900 Hamilton St., Philadelphia 30, Pa.

- ☐ Molded case circuit breakers for motor control centers
- ☐ K-LINE LV switchgear (600 v)
- ☐ Secondary unit substations
- ☐ TRANFO-UNITS†
- ☐ TELEMAND motor-operated molded case breakers
- ☐ Power switching centers
- ☐ URELITE® circuit breakers
- ☐ Metal-clad switchgear (4.16 and 13.8 kv)

†Tranfo-Unit is a Reg. TM of I-T-E

Name_____ Title_____

Company_____

Street_____

City_____ Zone_____ State_____

SEND COUPON OR WRITE

Get complete up-to-date information on I-T-E equipment

**An I-T-E trademark*

Specify

McGILL® *Levolier*® switches

...for guaranteed precision plus durability



The high standards of design, craftsmanship and material selection make it possible to guarantee No. 41 LEVOLIER switch unconditionally against failure in lighting circuits. This extra quality is reflected in the performance of all LEVOLIER switches.

It pays to specify the best to avoid frequent and costly replacement. LEVOLIER canopy, toggle, push button and momentary contact switches are recognized for their reliability and long life.

All are Underwriters' Laboratories inspected.

UNCONDITIONALLY GUARANTEED No. 41 single-pole, single-circuit, universal lever switch 6 amp. "T" 125V—3 amp. 250V. Only 5/8" thick, it is ideal for conduit box and canopy mounting for lighting and FHP motor control.

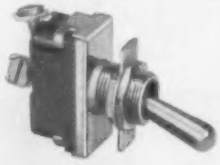
No. 100 single-pole, 15 amp. 125-250V, 1 HP 120-240V AC, normally "OFF" momentary contact switch. 1 amp., 125V—1/2 amp., 250V DC. Especially suitable for limit and safety control of industrial machinery.

No. 1901. Basic 30 amp. momentary contact switch rated 30 amp. 125 or 250 V AC, 1 HP 125 V —2 HP 250 V AC, 2A 125 V— 1/2A 250 V DC. Available SPST NO or NC, SPDT and SPST 2 ckt. with six standard actuators. Size 1.876" x .812" x .500".

No. 71 single-pole, single circuit, universal lever switch . . . the thinnest 6 amp. "T" 125V—3 amp. 250V switch of its kind on the market today — only 15/32" thick. Also with push button.



No. 25 toggle switch carries a 6 amp. "T" 125V, 3 amp., 250V rating with an S.P.S.T. double-break mechanism. 1/3 HP AC 120-240V. Ideal for panel board, FHP motors, appliances, power tools, etc.



No. 90 3/4 HP capacity, 15 amp. 125V, 10 amp. 250V toggle switch with an S.P.S.T. mechanism. Designed for AC operation. Also carries 20 amp. 125V AC non-inductive load for heater applications. Also available in two circuit with center off and no off. Choice of terminals.

For complete descriptions of the entire McGILL line of switches, sockets, portable lampguards and other electrical specialties, write for catalog No. 84.

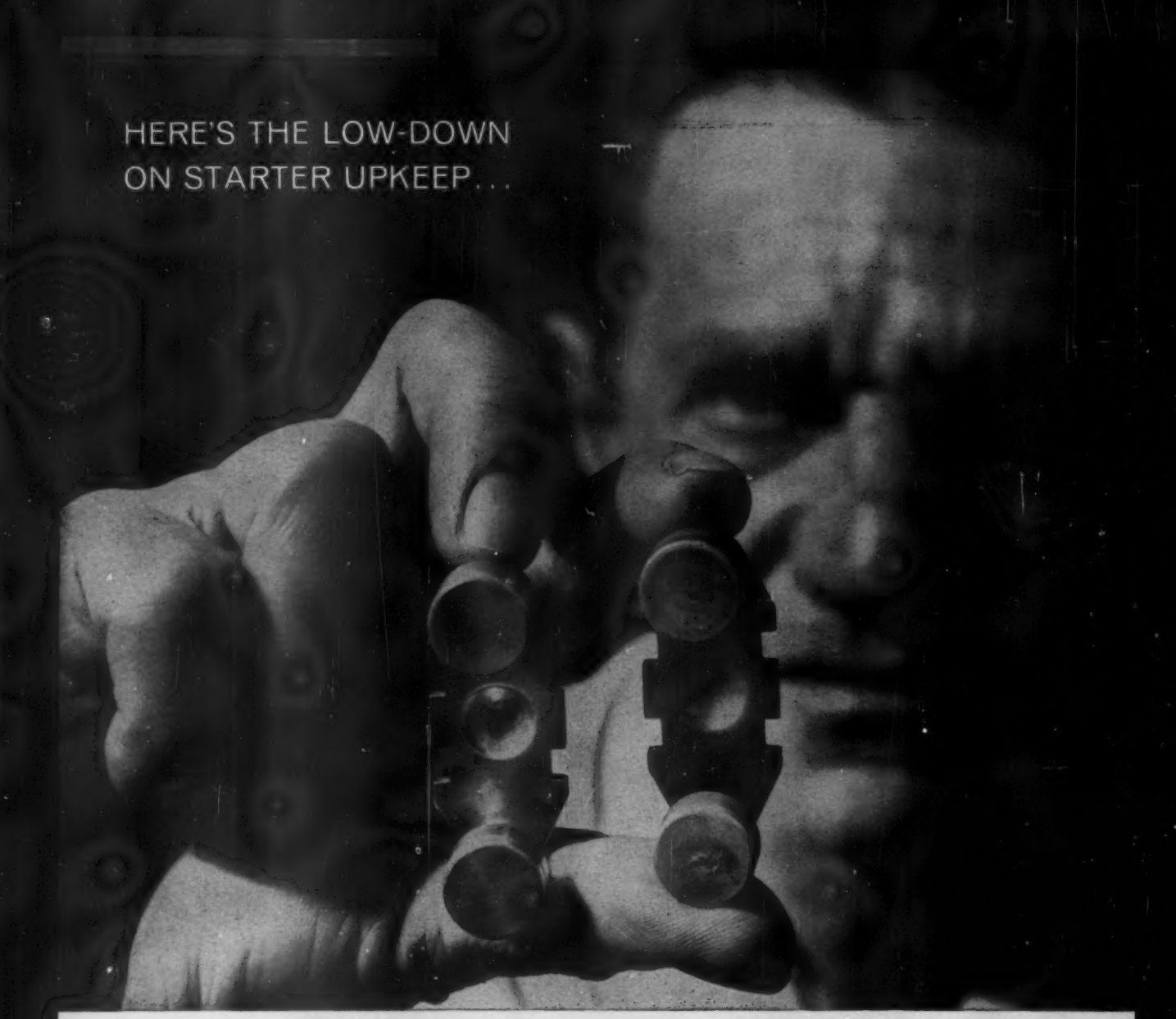
AVAILABLE FROM YOUR ELECTRICAL WHOLESALER

engineered electrical products

McGILL®

precision needle roller bearings

McGILL MANUFACTURING COMPANY, INC., ELECTRICAL DIV., 450 N. CAMPBELL ST., VALPARAISO, INDIANA



Contact tips hold up "like new" after one year's service to keep your maintenance down

The unretouched photograph above shows two sets of contact tips from a Clark Type "CY" A-C Motor Starter. One set has seen a year of continuous hard service with frequently as many as 5,000 operations per hour. The other set is brand new – unused.

Which contact tips were actually in service for one year? The obvious, but not too obvious clue is the slight discoloration and minute pitting in the tips at right above.

But you can easily see for yourself that even after one year of steady operation these tips show very little evidence of wear. Their present condition will assure many more years of dependable service, free of maintenance.

The secret? Clark's exclusive "arc quenching" principle incorporating the use of strong, multi-turn magnetic blowouts and double-break contacts.

The action of the magnetic field not only forces the arc to rotate, moving it continually over contact surfaces, but tends to "quench" it at the same time. Result: Less wear on contact tips and fewer maintenance headaches.

There are many more good reasons why the Clark Type "CY" Starter is your best *preventive* maintenance buy. For complete details contact your nearest Clark Controller sales office or distributor. Or, write direct. 881

The **CLARK CONTROLLER** *Company*

Everything Under Control • 1146 E. 152nd St. • Cleveland 10, Ohio

IN CANADA: CANADIAN CONTROLLERS, LIMITED • MAIN OFFICES AND PLANT, TORONTO



SMOOTH, "CUSHION" START

with new Century Electric part-winding start motor

This new motor . . . at either 1200 or 1800 rpm's . . . will give you smooth, "cushion" acceleration. No cogging, jerking or jarring equipment. No sub-synchronous stalling. Just dependable torque with the same 40% reduction in starting current of all Century Electric part-winding motors.

New winding—A special winding scheme makes this extra smooth start possible. Special cross connections are made between coil groups of the basic motor winding. Result: balanced stator field on first step position . . . no cogging . . . smooth acceleration. Means that now motors will give better performance on part-winding start. Also, more time can be taken for acceleration because the winding does not go "across the line" until the rotor has reached a higher speed.

Applications—Have an application where power company restrictions limit in-rush current? The complete line of Century Electric part-winding start motors is the answer. They provide the most economical and dependable way of starting equipment with low-starting torque such as fans, blowers, centrifugal pumps, and compressors, as well as reciprocating compressors equipped with unloading valves. And with new Century Electric part-winding motors heavier loads than ever before can now be brought smoothly up to speed.

Construction—Century Electric part-winding start motors are available in approximate range of 20 to 150 hp sizes and in speeds of 1200 and 1800 rpm. They all have the high quality construction features of all Century Electric squirrel cage induction motors . . . coils are insulated with tough polyvinyl acetal resin . . . windings are dipped and baked with several coats of high temperature synthetic varnish which protect against oil fumes, mild acids and dust and grit . . . rotors are dynamically balanced so that motors run with extreme quietness and smoothness . . . rugged cast iron frame construction assures long life and low noise level.

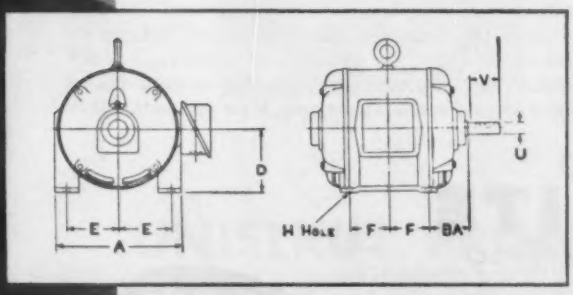
Application aid—A Century Electric application engineer will be glad to discuss your part-winding start problems with you. Century Electric also makes a complete line of motors . . . all sizes and types from 1/20 to 400 hp. For a copy of the new Century Electric Motor Application Guide, please write for bulletin 270A.

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

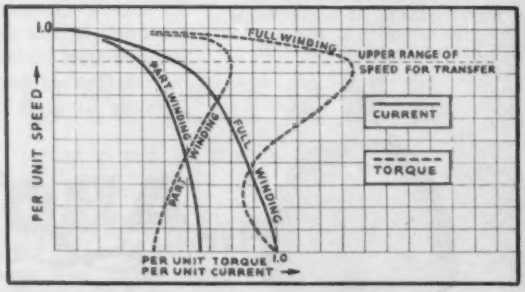
Century

59-10



TYPICAL 30 HP part-winding start motor dimensions

Frame Size	Key	A	BA	D	E	F	H	U	V
SC 326U	½ x ½	16	5¼	8	6¼	6	21/32	1⅛	5⅜



SPEED-TORQUE curves show how transfer to full winding can be made at higher speed after current has fallen off.



Photo courtesy Wheeling Steel Corporation, Wheeling, West Virginia (Benwood Works)

Wheeling Steel specifies...

Abolite uplight fixtures for extra eye comfort, economical high bay lighting

These Abolite uplight fixtures are mounted forty feet high, yet there's comfortable, glareless 32 footcandle average light throughout this high bay building. Light directed upward through the fixture's open top eliminates sharp contrasts by washing out dark background shadows. Glare is virtually eliminated by 35° lamp shielding.

Abolite's modern air-swept design also reduces maintenance costs. Air circulating through the fixture sweeps it clean of dulling dust.

You can choose from several Abolite uplight units for high bay lighting: 18" and 24" diameter Alzak aluminum fixtures for use with 400 and 1000 watt mercury lamps and 14" and 18" diameter Alzak aluminum fixtures for 300-500 watt incandescent lamps (ideal for gymnasium lighting). For full information see Sweet's Industrial Construction File 12i/AB, or write *Abolite Lighting Division, The Jones Metal Products Company, West Lafayette, Ohio.*

INSTALLATION DATA:
Abolite Cat. No. HMFAU-2400 Alzak aluminum uplight fixtures with 400 watt white reflector mercury lamps. Mounting height 40' with 16' x 20' spacing. Average footcandle level: 32.



ABOLITE Lighting

THE JONES METAL PRODUCTS COMPANY
West Lafayette, Ohio

eye·fi RE/LIGHTING



UNISTRUT metal framing is used extensively in the 35-acre Automatic Electric plant at Northlake, Illinois, termed one of the handsomest and most efficient factories in the nation. A subsidiary of General Telephone & Electronics, Automatic Electric is the largest manufacturer serving the independent telephone industry.

18 miles of UNISTRUT® metal framing used to speed construction of huge new Automatic Electric plant

UNISTRUT channel is used to support the entire electrical system, from point of entry of 4160 power cables to outlets at benches.





Intense illumination of more than 100 foot candles in testing area is provided by double bank of fluorescent fixtures, supported by UNISTRUT framing.

Entire fluorescent system of 7,120 fixtures is supported with UNISTRUT channel, which also provides a raceway for wiring.



The unequalled versatility of the UNISTRUT metal framing system made it a natural choice for electrical framing, supports, and many other uses in Automatic Electric's huge new plant.

Using the UNISTRUT system, the contractors benefited in many ways. The time and cost of detailed precision layouts were eliminated because continuous slot channel and a complete line of fittings enabled workmen to do precision work on the job.

By standardizing on UNISTRUT materials, the contractor got the advantage of dealing with one local source providing fast service, eliminating the need for ordering and follow-up through several suppliers and fabricators. Since no pre-designing was required, UNISTRUT products were stockpiled at the site and used as needed anywhere in the electrical system.

As versatile as lumber, UNISTRUT framing was also used for a wide variety of other purposes at Automatic Electric, such as building time card racks, pipe supports, storage mezzanines, racks and shelving. It continues to prove its flexibility in the plant, as engineering and maintenance personnel use it to make alterations quickly and easily.

For information on how the UNISTRUT framing system can save time and money on your next project, see your local UNISTRUT distributor.

UNISTRUT®
METAL FRAMING

UNISTRUT PRODUCTS COMPANY

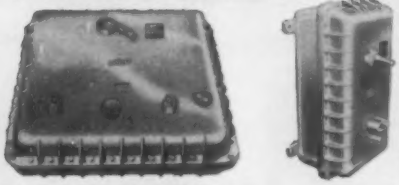
GENERAL OFFICES: 933 W. Washington Blvd., Chicago, Ill.
Telephone: MOnroe 6-2665 Teletype: CG 1329

Stocking distributors in all principal cities of the United States and Canada. Exported throughout the world.

When you install *be sure to use Killark*

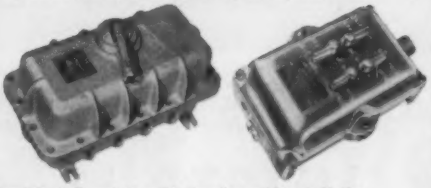
the *first* and most complete all-

MOTOR STARTER ENCLOSURES
Explosion-Proof, Dust-Tight, Weatherproof



Starters and Combination Starters Made to Order

CIRCUIT BREAKER ENCLOSURES
Explosion-Proof, Dust-Tight, Weatherproof



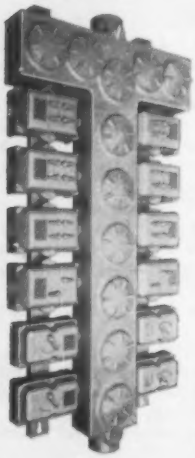
Furnished Complete with Breaker of Your Choice

JUNCTION BOXES
Explosion-Proof, Dust-Tight, Weatherproof



More Than 40 Sizes Custom Hubs

PANEL BOARDS
Explosion-Proof, Dust-Tight, Weatherproof



Completely Wired—Ready to Install

ENJOY THE *Plus* ADVANTAGES OF A *100%* ALUMINUM INSTALLATION!

- **Lightweightness.** You save labor, cut transportation and handling charges. Aluminum weighs ⅓ as much as iron; one man can handle an all-aluminum installation which may have required two men when other metals are used.
- **Ease of Installation.** Aluminum conduit bends without collapsing, shapes up quickly. Killark fittings have clean threads and plenty of wiring room—and are designed for easy installation.
- **Non-Sparking.** An important safety factor in hazardous areas.
- **Non-Rusting, Non-Corroding.** Exclusive Killark aluminum fittings are long on life, short on maintenance. Smooth, bright, clear-through durability; they never rust and are more corrosive resistant than other types.

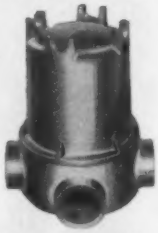
Make your next installation an *all* aluminum one—aluminum conduit and 100%-aluminum Killark fittings. The best costs less in the long run.

INSTRUMENT BOXES
Explosion-Proof, Dust-Tight, Weatherproof



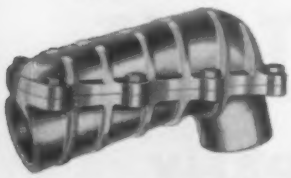
Several sizes Glass Lens Covers Available

SPLICE BOX Explosion-Proof



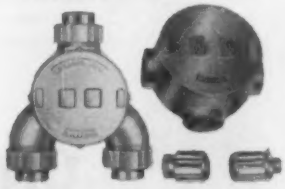
Available 1¼"—1½"—2" with Various Hub Styles

PULLING ELBOW
Explosion-Proof



Very Rugged Construction Various Sizes

FITTINGS Explosion-Proof



Complete Line of Fittings & Accessories

Killark

KILLARK ST. LOUIS

ELECTRIC MANUFACTURING COMPANY

Vandeventer and Easton Aves. • St. Louis 13, Missouri

Aluminum Conduit...

ALUMINUM FITTINGS AND FIXTURES

aluminum line!

JUNCTION BOXES
Explosion-Proof



Screwcap Style
Many Sizes—Custom Hubs

DUST-TIGHT FIXTURES



Available In
Pendant,
Bracket &
Ceiling Types
100W—150W—200W

VAPOR-PROOF FIXTURES



Pendant,
Ceiling,
Bracket Types.
60W to 500W.

EXPLOSION-PROOF FIXTURES



Available in
Pendant,
Bracket &
Ceiling Types.
60W thru 500W.

FLUSH SWITCH FITTINGS
Single thru 5-Gang
Shallow &
Deep Styles



ENTRANCE FITTINGS
Threaded and Speedolet Types

½" thru 6"



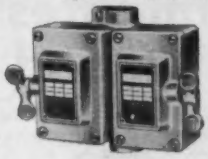
...AND ENJOY THE *Completeness* OF THE KILLARK LINE!

Whatever the installation, Killark can provide the correct aluminum fitting or fixture. That's because Killark has been supplying the electrical needs of contractors for over 45 years. In 1942, Killark pioneered the use of aluminum and now manufactures exclusively the *only* complete line of aluminum fittings and fixtures. *They cost no more than malleable iron fittings.*

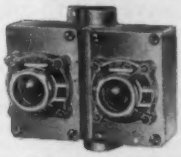
There are thousands of fittings in the constantly expanding Killark line. Many years of research, design and development are your assurance of the finest aluminum fittings at the lowest possible cost. Fast delivery is assured through convenient warehouse stocks in many cities.

THE KILLARK ILLUSTRATED CATALOG IS YOURS ON REQUEST

SWITCHES—PILOT LIGHTS
Explosion-Proof, Weatherproof



Switch



Pilot Light

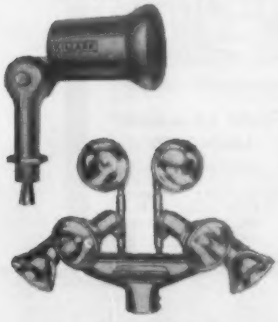
Single and 2-Gang

PLUGS & RECEPTACLES



Complete Line
Explosion-Proof
and Weatherproof

CLUSTER LIGHTS



150W to 500W.
Versatile in Design

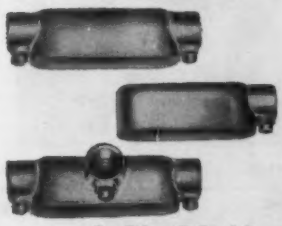
KILLARK REPRESENTATIVES

*Atlanta, Ga.
Baltimore, Md.
*Boston, Mass.
*Buffalo, N. Y.
*Chicago, Ill.
*Cincinnati, Ohio
*Cleveland, Ohio
*Dallas, Tex.
*Denver, Col.
*Detroit, Mich.
Kansas City, Mo.
*Los Angeles, Calif.
Milwaukee, Wisc.
Minneapolis, Minn.
New York City, N. Y.
Omaha, Neb.
*Philadelphia, Pa.
*Phoenix, Ariz.
*Pittsburgh, Pa.
Richmond, Va.
*San Francisco, Calif.
*Seattle, Wash.
Honolulu, Hawaii

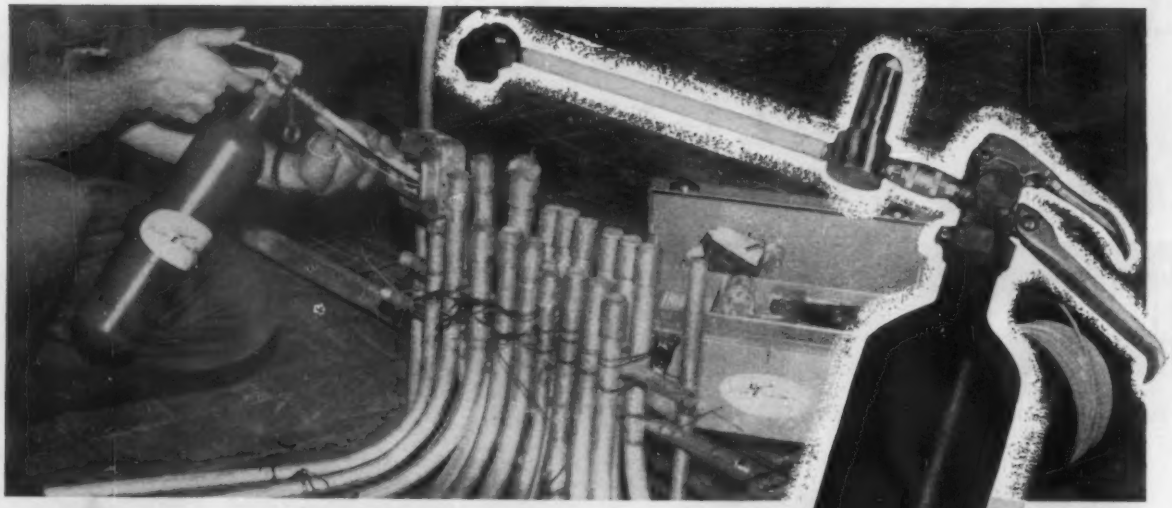
Sales Offices and Warehouse Stocks throughout Canada

*Warehouse Stocks

SPEEDOLETS



For Thinwall Conduit
All Sizes thru 2"



NEW Jet Line Cylinder

eliminates snaking in 1/2" and 3/4" conduit!

*Pat. Pending on Entire Method and Apparatus

You can throw away your fish tape, because the new Jet Line Cylinder makes short work of wiring ½" and ¾" conduit . . . SAVES UP TO 70% of wire-pulling costs!

With the Jet Line Cylinder, you can lay a line through one . . . ten . . . even fifty conduits in a few minutes, regardless of lengths, bends, or loose obstructions! Just place a line package in the conduit and secure the free end of the line. Butt the Jet Line Cylinder seal-off assembly to the end of the conduit and activate the valve . . . tremendous pressure, unleashed by the expansion of a harmless gas, travels the lightweight line package through the entire length of the conduit in a split second! The strong nylon line, laid down by the speeding package, is used to draw polyethylene rope . . . then wire . . . through the conduit in minutes!

Completely safe, the Jet Line Cylinder uses no inflammable substances or explosives of any kind. Both the nylon line and polyethylene rope are non-conductors, so there's no danger in working hot panels.

The Jet Line Cylinder Kit can pay for itself on one or two jobs! Kit contains: cylinder with valve, pressure regulator, valve operating mechanism, and full pressure attachment with variable head. Cylinder can be refilled; spare cylinders available. Order your Jet Line Cylinder Kit today . . . forget fish tape forever!

★OPERATES UNDER ALL CONDITIONS



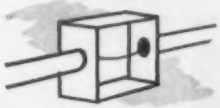
Water, sand, and mud are no obstacles for the Jet Line Cylinder! Package cannot become lodged in pipe — actually clears loose obstructions.

★USE IN ANY LENGTH ½" or ¾" CONDUIT



Sweeps through multiple bends, offsets . . . eliminates snaking in any length conduit. Jet Line Cylinder is economical to buy and use. Easy to handle . . . weighs only 9 lbs.

★CAN JUMP BOXES



In short runs when conduit openings are in line.

★USE AS A LINE LAUNCHER



Make a barrel with 2 ft. length of conduit . . . shoot line over rafters, through crawl space, etc.

OWN THE COMPLETE JET LINE SYSTEM*

Jet Line Cylinder for ½" and ¾" Conduit • Jet Line Gun for Conduit 1" or larger



You'll be prepared for all conduit wiring problems when you carry the complete Jet Line System . . . the Cylinder and the Gun.

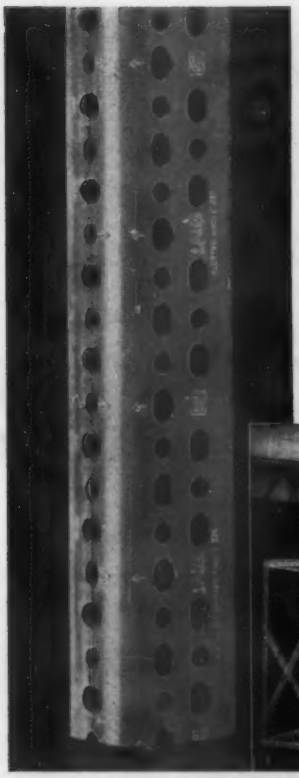
SAFE, QUICK, SURE, the Jet Line System was invented by experienced electricians and has been thoroughly job tested. Compare the speed and simplicity of Jet Line with long hours spent in snaking . . . you'll count the time you save in dollars!

For complete information and prices, write your distributor or

Jet Line Gun Company

730 Seigle Street, Charlotte, N. C.

4130



FREE MANPOWER HOURS



...are yours when you use AIM SLOTTED ANGLE

Every day, cost conscious electrical contractors, electricians, and lighting engineers, are gaining FREE MANPOWER HOURS with AIM Brand Slotted Angle. Only AIM Brand Slotted Angle has this proven combination of time and money-saving features...

- exclusive AIM Brand Slotted Angle pattern of precision engineered ⅜" slots and round holes adapts to all standard electrical fittings without reaming or special attachments... gives FREE MANPOWER HOURS.
- customized, job-site framing and last minute design modifications are no problem with AIM Brand Slotted Angle, because pieces are quickly and easily cut to length on the spot with an AIM Brand Cutter and simply bolted together with no drilling, sawing or welding required... gives you FREE MANPOWER HOURS.
- arrow-shaped cutting marks every 3" give you a built-in measuring system for faster job planning and cutting... means FREE MANPOWER HOURS.
- structures framed with strong, cold-reduced AIM Brand Slotted Angle galvanized steel require a minimum of maintenance... means FREE MANPOWER HOURS.

AIM Brand Slotted Angle is a product of the Acme Steel Company, U. S. pioneers in slotted angle framing material and is backed by 7 years of on-the-job know-how and laboratory testing, giving you an experience-proved product. A nation-wide network of distributors stock AIM Brand Slotted Angle and AIM Brand Slotted Angle Accessories.



FREE! Ideas-In-Action Reports

Send today for your AIM Brand Slotted Angle Idea literature. You'll learn how others are solving tough building and framing problems with AIM Brand Slotted Angle... while gaining FREE MANPOWER HOURS.

ACME STEEL **AIM Brand Slotted Angle** AIM

Mail to: Dept. EBD-119
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Acme Steel Company, Chicago 27, Illinois

Yes! I would like to know more about AIM Brand Slotted Angle and how I can gain FREE MANPOWER HOURS. Please send me AIM Brand Slotted Angle Idea literature.

NAME_____

TITLE_____

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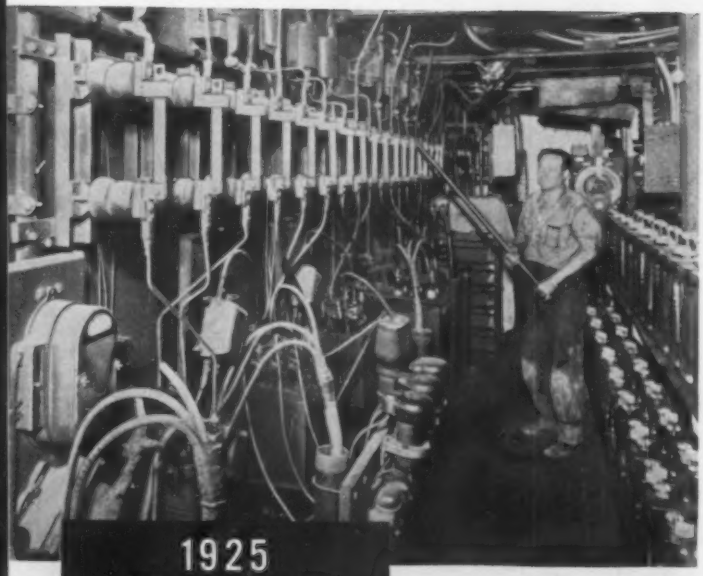
CITY_____ STATE_____

POWER
FOR TOMORROW

Will yesterday's or today's . . .

POWER DISTRIBUTION SYSTEMS

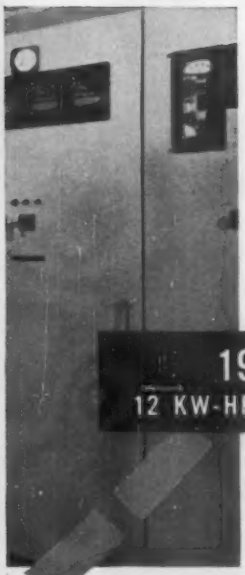




1925
2 KW-HR/MANHOUR

1975
32 KW-HR/MANHOUR

SATISFY TOMORROW'S POWER NEEDS



1959
12 KW-HR/MANHOUR

In 1975, only 15 years from now, a population of 230 million Americans will require an expansion of 75 per cent in industrial output over 1959 levels. This is the forecast. Posing a dilemma, manhours to boost production to this level will increase by only 5 per cent.

A more intensive use of electricity in larger numbers of more productive machines must bring about a great increase in the productivity of the American worker.

This means, of course, more kw-hr per worker. It means, in fact, that the worker of 1975 will require 32 kw-hr as against the 12 kw-hr he uses for each hour of work today!

Predicted industrial loads will double in ten years, triple in fifteen. Yet even today, many plant power distribution systems—while adaquate for normal loads—have peak demands which leave them little room for increased product output. Will your power distribution system satisfy tomorrow's power needs?

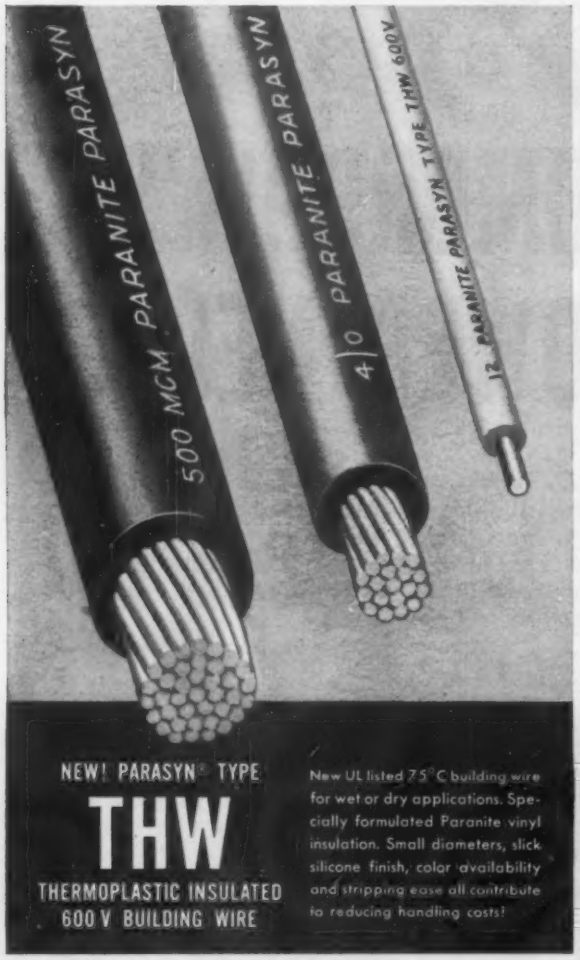
If you need help in checking the adequacy of your present or planned system for tomorrow's anticipated loads, call the General Electric Apparatus Sales Office nearest to you. Industrial Power Systems Sales Engineers are ready to bring General Electric's total capabilities to bear on your problems. General Electric Company, Section 680-18, Schenectady 5, N. Y.

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PARANITE THW and RHW

Two types available for 75°C wet or dry specified applications



NEW! PARASYN® TYPE

THW

THERMOPLASTIC INSULATED
600 V BUILDING WIRE

New UL listed 75°C building wire for wet or dry applications. Specially formulated Paranite vinyl insulation. Small diameters, slick silicone finish, color availability and stripping ease all contribute to reducing handling costs!



MYLAR TAPED*
PARATEMP® TYPE

RHW

600 V BUILDING WIRE

Taped with * Dupont "Mylar" (AWG 6 and larger) to provide an improved moisture barrier with higher dielectric strength. Resulting diameter reductions, better fit conduit. Saturated and impregnated, braided sheath, lubricated with special waxes to reduce pulling resistance.

Both UL listed 75°C wet or dry location

Here are two improved building wire products—both offering you outstanding performance in similar installations. Standard colors available from stock in both solid and stranded, sizes 14 AWG through 500 MCM for the THW . . . and 14 AWG through 1000 MCM for the RHW. Get acquainted with advantages of both wires—write today for complete technical information!

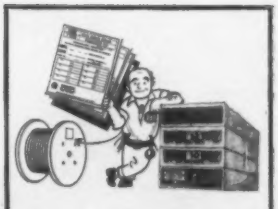
PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Marion, Indiana

Sold only through recognized electrical distributors

MANUFACTURING PLANTS: Marion, Ind.; Jonesboro, Ind.; Tiffin, Ohio; Anaheim, Calif.

Sales Offices and Redistribution Warehouses in all Principal Cities



Each Carton packaged to reduce handling and labor cost with "color-coded" labels plainly showing type, size and color of wire. Also, new reel cards for instant identification and inventory control.

59TH YEAR • NOVEMBER 1959

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Estimating Procedure Tightens

At the Florida Electrical Contractors Association meeting in Jacksonville last month, a lively panel discussion of estimating practice had to be extended to double its scheduled time to accommodate the interest of the audience. An exceptionally talented panel of experts, Carl Evans of "Electrical South," Jack Dalton of National Price Service, and Ralph Johnson of "Estimatic" fame, conducted the sessions. But the keen audience reaction was also testimony to an awakening concern among the contractors for their most critical business process.

In recent years there has been no want of adequate business volume. The prospects for sustained high levels of activity promise, in fact, to stretch the total resources of the industry. But sharp competition has eroded margins in the presence of mounting risks and many contractors are sick and tired of trading dollars for, at best, a precarious return for their efforts. Better, more accurate, estimating is needed to predict real costs.

Accurate estimating is no cure-all for industry ills, but it is an elementary necessity for survival in this kind of market environment. The contractor who uses precise estimating methods closely correlated with his own job experience may not win all the bidding contests, but he guards his money, organization and manpower from being tied up in profitless activity.

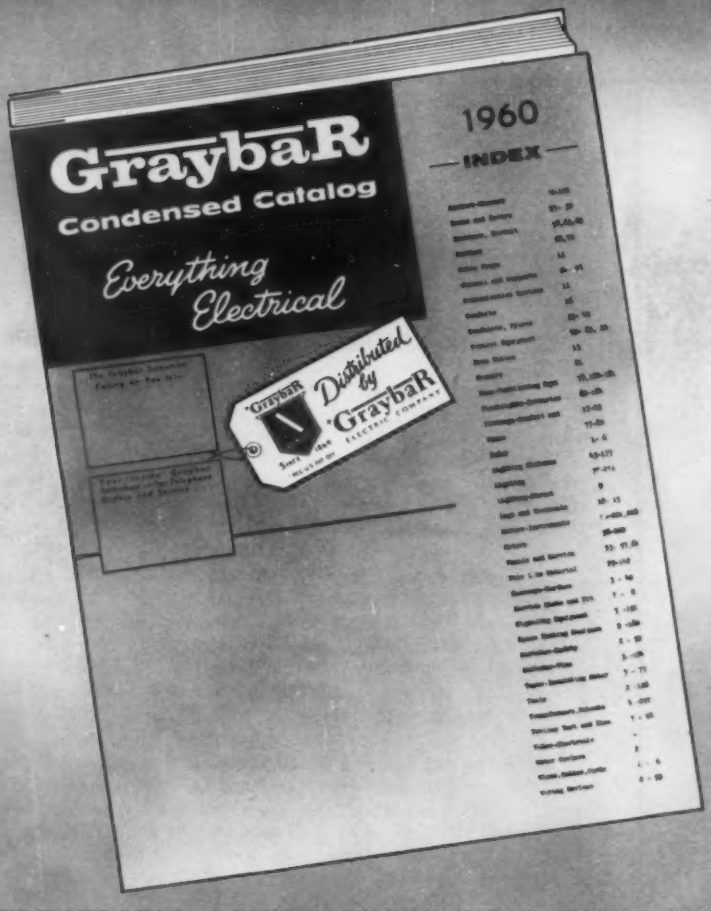
Jobs won on sloppy estimating, which happens all too frequently, are sick pups from the outset. If estimating errors exceed the calculated profit margin, it takes a mathematical miracle to produce black figures. With today's thinner margins, crude estimating, which might have got by ten years ago, is no longer tolerable.

Beyond outright incompetence, there is no excuse for poor estimating in electrical construction today. There are excellent labor data manuals available. There is a wealth of practical data and guidance in fine up-to-date books like Ashley's "Electrical Estimating" and Johnson's "Electrical Construction Cost Manual." There are fast, accurate material price services available, always on top of current price changes. No previous generation of electrical contractors could tap such rich resources of precise information at such a modest cost.

Current interest in tightening up estimating procedures is healthy. Contractors who know their costs and can trust the accuracy of their estimates are not likely to take out-size risks in bidding. With no miracles or magic numbers in the estimate, the profit markup becomes a tangible entity and not just a fond hope.

Wm. T. Stuart

REVISED... EXPANDED... BRAND NEW!



QUALIFIED ELECTRICAL CONTRACTORS WILL FIND THIS CATALOG the finest, most complete catalog yet produced by any electrical distributor. The catalog contains over 200 pages of the fastest moving, most wanted items electrical contractors need and use. All items are listed, arranged and priced for quick selection. Included is a 40 page LIGHTING SECTION, A SIMPLIFIED LIGHTING PLANNING SECTION, a 30 page TOOL SECTION and even 6 HANDY SELF-MAILER ORDER BLANKS. Nowhere except at Graybar will you find a catalog like this! QUALIFIED ELECTRICAL CONTRACTORS (in the U.S. only) CAN HAVE THIS CATALOG, no charge, by writing on their business stationery to the address below giving full name, title, firm name and address. The catalog will only be delivered personally (not mailed) by a Graybar Salesman. 937

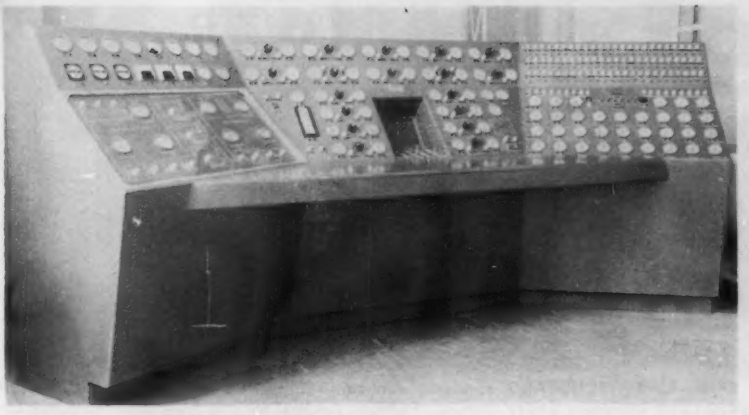
Graybar Service includes: Objective recommendations • On-the-job technical help • Most complete lines • Planned stocks to meet your needs • Expert counter service • Speedy handling of will-calls.

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Everything Electrical GraybaR

ELECTRICAL CONSTRUCTION AND MAINTENANCE



CONTROL CONSOLE on 4th floor provides centralized remote control of some 55 motors through an IBM electronic operations panel. Included are air conditioning system gages, pilot lights and alarm lights for main power, fire pump, sump pumps, etc.

Electrical System at

National Bank Of Detroit's New Building

features . . .

- Armored cable primary distribution
- Vertical bus ducts for 480/277 and 120/208-volt systems
- Novel floating louvered ceilings plus air-diffuser fixtures for lighting
- Console control of motors and unique security alarm system
- Five separate interconnectable PA systems for background music and emergency use.

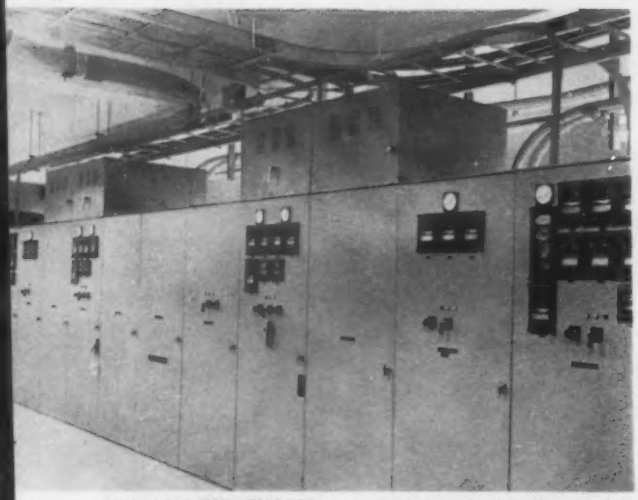
By L. J. Sever, *Associate, Albert Kahn Associated Architects & Engineers, Inc., Detroit, Mich.*

ELECTRICAL facilities play a vital role in the daily operation of the National Bank of Detroit's new headquarters building recently completed in the heart of Detroit's financial district. The attractive, dignified 14-story building occupies an entire block; is devoted exclusively to banking; incorporates the most modern of architectural, lighting and electrical system concepts.

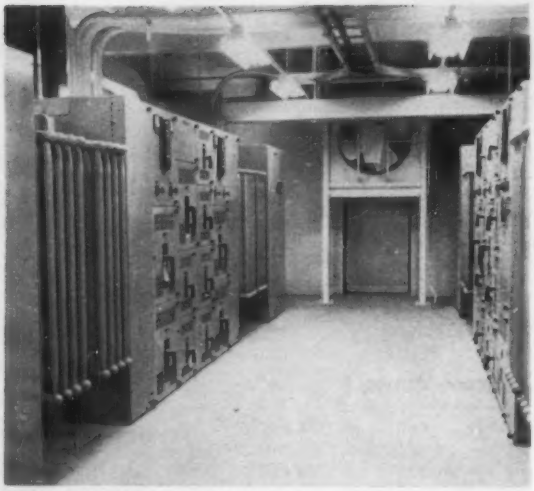
Designed by Albert Kahn Associated Architects and Engineers, Inc., Detroit, the new building has an interesting exterior tapestry-like effect created by an offset pattern of windows, floor by floor, alternating with porcelain enamel and marble panels. At ground level is a story-and-a-half arcade with a recessed glass facade offering an unobstructed view of the main banking floor on the North and East sides.

Throughout the building interior, lighting of excellent quality and intensity has been used as a design medium to enhance architectural features. Lighting levels range from maintained intensities of 60 fc for most areas to 100 fc over tellers' cages on the main floor.

Systems incorporating a variety



PRIMARY SWITCHGEAR is served by dual-cable (fireproofed) 4800-volt incoming utility circuits. Primary feeders to unit substations are 3-conductor armored cables in aluminum ladder racks.



UNIT SUBSTATIONS are double-ended type; have two 1000-kva transformers. Unit at left is 480/277-volt for power and fluorescent lighting; at right, 208/120-volt for business machines and other lighting.

of utilization voltages serve power, lighting, business machines, communication, alarm, public address and security protection equipment. Armored cables, bus duct, conduit raceways, underfloor ducts and cellular flooring combine to provide an excellent degree of electrical distribution flexibility.

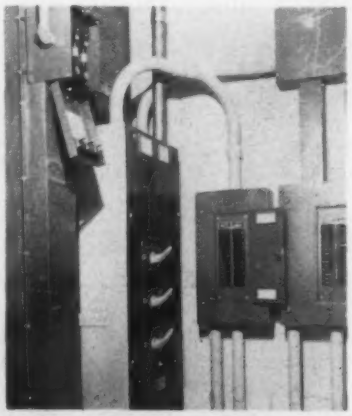
General contractor on the project was Bryant & Detwiler Company, Detroit. Electrical installation was by J. Livingston & Company, New York City.

Primary System

Primary 4800-volt, 3-phase, 60-cycle power originates at two separate substations of the Detroit Edison Company; enters the building in two underground dual-cable circuits. These circuits consist of two 3-conductor, 450 mcm, paper and lead covered cables; feed individual buses of the metal-clad primary switchgear; are equipped with automatic throwover in case of low voltage, cable failure, or complete voltage loss due to power failure. Provisions were made for future installation of a third dual-cable primary circuit.

The 4800-volt primary switchgear has a 250,000-kva interrupting capacity, supplying primary power direct to two 800-hp, centrifugal refrigeration compressors—one on each incoming bus. Compressor feeders are 3-conductor, No. 2/0, aluminum armored cables with rubber-insulated copper conductors. Each primary bus also has two feeder cubicles for four double-ended unit substations which handle the secondary voltage requirements of the building. Unit substation feeders are 3-conductor, 350 mcm copper-conductor, aluminum armored cables. All primary armored cables are carried horizontally and vertically on aluminum ladder racks.

All metering facilities for kilowatt hour (kwh), reactive kilovolt ampere hour (rkvah), and demand load are provided in the incoming line cubicles of the primary switchgear.



FLOOR ELECTRICAL CLOSETS contain 480/277-volt (1000-amp here) fluorescent lighting bus duct at left and 208/120-volt, 1600-ampere, bus duct with distribution and branch circuit panels for 120-volt incandescent lighting, business machines and receptacles.

Secondary Distribution

Secondary power at the required utilization voltages is provided by four double-ended unit substations, each with two 1000-kva transformers, primary switch cubicles and secondary switchgear. Three of these unit subs are on the fourth floor, one in the penthouse.

Two of the 4th-floor subs provide 480/277-volt, 3-phase, 4-wire distribution for 480-volt motors and all 277-volt fluorescent lighting. The third unit provides 208/120-volt power for business machines and all incandescent lighting throughout the building.

The penthouse substation supplies the entire penthouse power load. This includes: a 400-hp, centrifugal refrigeration compressor; 17 elevators; numerous pumps; cooling tower fans; supply, exhaust and recirculating fans; heating and ventilating units.

Power feeders from the 480/277-volt substation switchgear supply a total of nine motor control centers in the second basement, mechanical equipment rooms, fourth floor and penthouse. Kitchen and dishwashing room power is provided by a separate 480-volt feeder from the 4th-floor substation. Transformation to 208/120 volts takes place near the kitchen area.

Console Control

A specially designed control console on the fourth floor, permits re-

mote control of a large number of the building's mechanical and electrical services. From this location, it is possible to start and stop 55 different motors by means of an IBM electronic operations panel. Indicating lights are provided for compressors, cooling tower fans, chilled water and condenser water pumps, compressor current loads, time meters, and hot and cold duct temperature gages. Also included are alarm lights to indicate main power throwover, fire pump operation, power failure, high level in sewage and sump pump pits, operation of oil interceptor sumps, and steam measuring meters. In addition, the IBM clock system on all floors is a part of the electronic system.

Bus Duct Risers

There are two mechanical service cores, one each on the north and south building area, with electric closets on each floor level. These closets contain the necessary distribution and branch circuit panels and two vertical bus duct systems for the 277-volt fluorescent and 120-volt incandescent lighting (plus 120-volt business machines and receptacles).

Fluorescent lighting on each floor is served by a run of 480/277-volt, 3-phase, 4-wire, full capacity, aluminum plug-in bus duct originating at the 4th-floor unit substations. One run of 600-amp duct goes down to the second floor. Branch-circuit panels are fed by fused plug-in switches mounted on the bus duct.

A 1000-amp bus duct extends from the 4th through the 9th floors, serving fluorescent lighting on all intermediate floors and the penthouse. Design provisions were made for extending this bus duct in the future when the presently unfinished 10th, 11th, and 12th floors might be needed.

The second bus duct in each service core, and associated electric closets, is a run of 208/120-volt, 3-phase, 4-wire, half capacity neutral, low impedance aluminum bus. This extends from the 2nd to 9th floors inclusive, at each service core, and is fed by the 208/120-volt unit substation on the 4th floor. Feeder panels with fused switches are built on the bus at the joints in the electric closets, serving adjacent distribution panels for incandescent lighting, receptacles and business machines on each floor. Two such lighting panels are installed in each closet on all floors except the 8th and 9th, where three panels are needed at each end of the building.

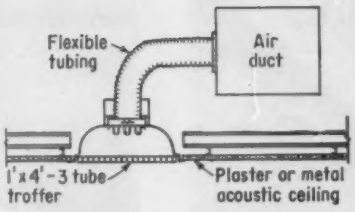


FIG. 1. COMBINATION FIXTURE for fluorescent lighting and air diffusion. Low-velocity air flow comes from air duct, area below, where only bottom of fixture is visible.

Grounding System

The building structural steel is grounded through a No. 4/0 perimeter ground bus connected to six groups of ground rods in triangular formation. Every external building column is tied to this perimeter bus and about 30% of the main internal columns are also connected to cross buses. Vertical risers of ground cable are carried up near each core, through the electric closets to ground substations, motor control centers, panelboards and other electrical equipment. The vertical risers connect together in the penthouse area to form two paths to ground.

Resistance of the grounding system rod groups, as installed, ranged from zero to 1.2 ohms. The calculated combined resistance of all groups was .092 ohms.

Lighting Techniques

Several design techniques were used to provide lighting of excellent quality and intensity to meet both functional and architectural criteria. These include louvered ceilings, combination fixture and air diffuser units, lens-enclosed troffers and incandescent down-lighting.

LOUVERED CEILINGS

Louvered ceilings are used extensively for lighting the main banking floor; the mezzanine customer contact area; the executive and trust areas, including private offices on the 2nd and 5th floors; and the staff floor meeting room (between 7th and 8th floors).

On the main banking floor, the louvered area extends over the high bay area, tellers' cages, officers' island, and the business "Instaloan" section. The ceiling in the staff floor meeting room is 1 ft higher at the center than at side and end walls. Here, the strip fixtures above are circuited to permit half or full intensity illumination and the curved perimeter side and rear walls have one circuit on dimmer control to permit a wide variety of lighting patterns. Standard cool white fluorescent lamps are used above all louvered ceilings with the exception of the business Instaloan section, which has deluxe cool white.

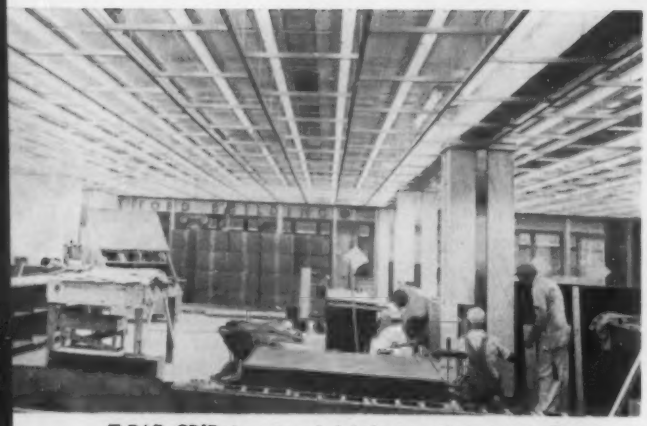
Louvered ceilings consist of a grid system of "T" bars, wall angles and closure strips (Fig. 2). The "T" bars are continuous in the east-west direction and offset alternately in the north-south direction. They support framed panels of gold anodized aluminum cells, fabricated in 1¼-in. hexagon pattern, which are lighted from above with continuous rows of single, 4-ft, rapid start lamps. On the main and mezzanine floors, the 2-in. deep louvers provide approximately 57° cutoff. On the 2nd, 5th and staff meeting room floors, cutoff is 45°.

AIR DIFFUSER FIXTURES

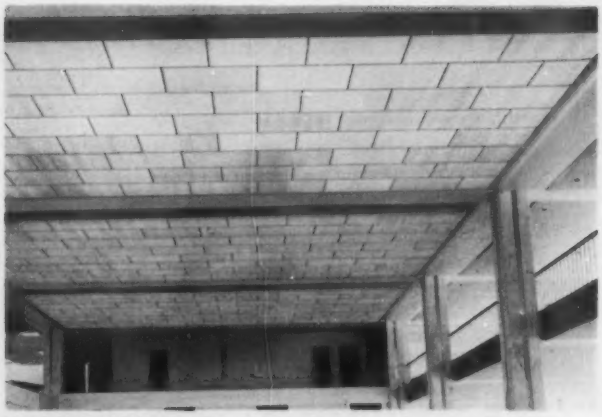
A combination ceiling fixture and low-velocity air diffuser provides illumination and air movement in several offices, conference, and lounge areas of the 2nd, 5th and staff floors. The unit—first of its kind—consists of a louvered-bottom, flush-mounted fluorescent fixture with small side slots which transmit a vertical air flow from a low-velocity diffuser mounted above. Air diffuser (Fig. 1) is connected by flexible tubing to an air duct. The combination unit thus provides the desired lighting effects without the cluttered appearance created by separate diffusers and lighting fixtures and helps conceal the mechanical air conditioning system components. Standard cool white lamps are used in all fixtures.

OTHER LIGHTING

Lens-enclosed, 3-lamp, fluorescent troffer units provide a maintained intensity of 60 fc in the main work areas on the 3rd, part of 4th, and all of the 6th through 9th floors. At present, only two 40-watt, rapid-start lamps are used. The fixtures



T-BAR GRID is suspended below continuous-row fluorescent strips to form framework of louvered ceiling areas.



FLOATING PANELS with gold anodized aluminum louver sections provide functional and decorative lighting over main banking floor. Each panel is 20 ft by 45 ft. Note down-lighting above and below mezzanine at right.

contain a single-lamp ballast and sockets for a future third lamp, if and when it is required. All 2-lamp and single-lamp ballasts are fused and the troffers are fitted with No. 71 Crystopal lenses. Standard cool white lamps are used on the 3rd floor. On other floors, the bank is experimenting with one standard cool and one warm white lamp in each fixture.

The cafeteria serving and dining areas on the staff floor is equipped with incandescent downlights and 4-ft-sq fluorescent units with ½-in. by ½-in. by ½-in. aluminum louvers. Kitchen and dishwashing areas have flush troffers with smooth Alba-lite lenses. Warm white lamps are used.

Throughout the building, glare-free and shadow-free lighting has been carefully designed to meet the functional and decorative requirements of various areas. One highlight is the down-lighting in the arcade of the main floor and lobby area and some elevator lobby space.

Lower floors of public contact areas and the large vaults have flush fluorescent troffers (one cool white and one warm white lamp) with No. 71 Crystobal lenses. Down-lighting is used for corridor illumination.

Music System

Another outstanding feature of the bank's electrical installation is the provision made for background music on all floors except the 2nd and 5th. Five separate systems are used. They can be bridged together when necessary or desirable and also can be used for emergency calls by the bank's security police.

System 1 serves the main banking floor and mezzanine area. It is binaural in nature and has a tape play-back unit designed for stereo.

System 2 covers the public contact area of the safe deposit floor and the lower banking floor Insta-loan area, using the record player of System 3 as a music source.

System 3 is the largest of the five systems. It serves the trust vault on the safety deposit floor; the coin and currency processing and non-public areas of the lower banking floor; portions of the 3rd and 4th floors; all of floors 6 through 9; the cafeteria, kitchen and general file room on the staff floor.

System 4 serves the staff floor meeting room. It is designed for movie sound and voice, with the amplifying equipment located in the projection room. Bridging connections, to permit simultaneous operation with the other units in the system, are in the projection booth. All equipment for the remainder of the entire music system is located in a console in the lounge area.

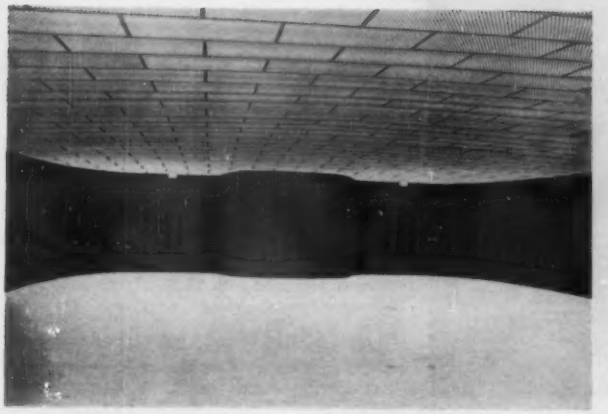
System 5 is for the staff floor lounge. It has a separate record player for personal records and facilities for personal record player or tape recorder to input of system. The lounge also has a television set for video only, built into the same console housing the other music equipment. Audio is provided through System 5 components.



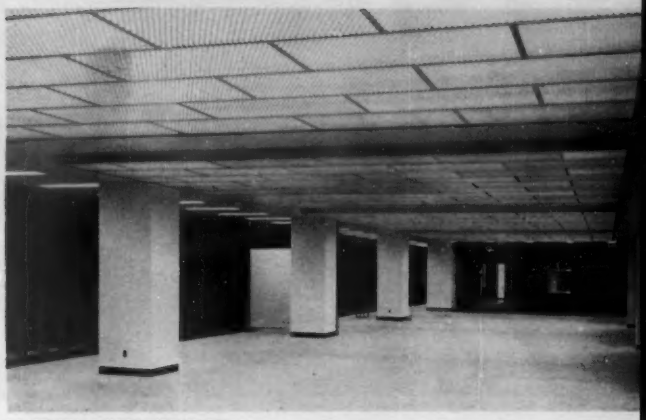
LENS-ENCLOSED flush, 3-lamp, fluorescent troffers typify general lighting of work areas on more than half the floors. Only two lamps are used at present; a third can be added later.

Communication Systems

Telephone service is handled through a large telephone equipment room on the 9th floor and an 11-position switchboard in an adjoining room. Separate closets, adjacent to electric closets on each floor, house the telephone relays,



SLIGHTLY ARCHED louvered ceiling lights staff floor meeting room. Center of ceiling is 1 ft higher than four sides. Circuiting provides half and full intensity and dimmer control on perimeter circuit.



TWENTY-FOOT SQUARE louvered floating panels combine with air diffusion fluorescent troffers at left to light 5th floor trust administration department.

the equipment and connections.

Distribution flexibility for telephone, signal and 120-volt circuits in most areas is provided by one of two methods, depending upon floor construction.

Underfloor Duct is installed in the basement floors, most of the main floor and fifth floor. The 3-duct steel system has a large duct for telephone and standard No. 2 size for the 110-volt and signal circuits.

Cellular Flooring is installed in the following areas: officers' island and business Instaloan section of main banking floor; mezzanine, 2nd and 3rd floors; two-fifths of the 4th, 6th and 7th floors; one-half of the staff and 8th to 12th floors inclusive. By "activating" every other floor cell, access to each type of service is provided on 3-ft centers, north and south, and at almost any location, east and west.

Security Provisions

Separate Telephone System. The bank's 17 elevators, two starter stations, penthouse, and the police room are equipped with a dial-type telephone system independent of the building's telephone facilities.

Emergency Lighting is provided in all elevators with conversion equipment operated from battery sources in each penthouse.

Alarm Signals from all fire alarm and watchman stations, sprinkler riser alarms, supervised door alarms, local alarm calls, day raid alarm calls, and vault protective alarms are received at a console in the bank police department office. Two recorders tape all signals. One records only local alarm and day raid alarms, the other records all other signals received.

Day raid calls also are transmitted direct to the Detroit Police Department headquarters. The console in the bank's security headquarters also has signal lights and bypass switches for all supervised doors.

Closed-Circuit TV cameras installed in the garage area permit the monitoring and operation of the garage entrance door from the console in the bank police office to admit trucks at night or on weekends.

Fourteen Annunciators, strategically located within the building, will indicate a local or day raid call from any area or teller's cage.

Sound Detection in vaults is provided with a transistorized, microphonic, sound detection system which will alarm in event of all tampering on the vault or heat tampering of the door.

The police room and guard posts on the lower banking floor are supplied with an intercommunication system which also connects to the building engineer's office.

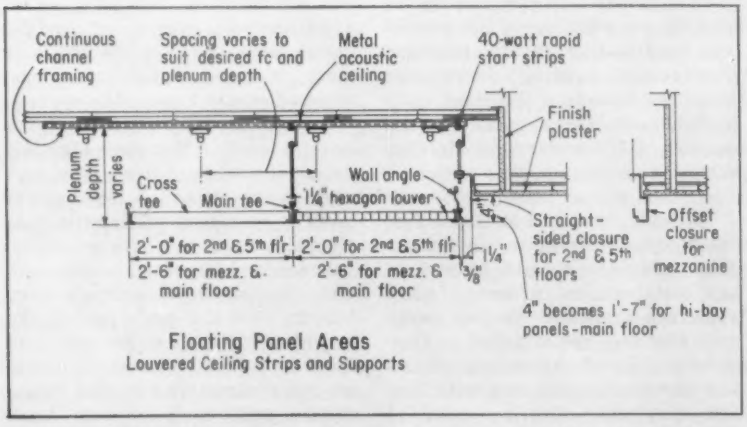


FIG. 2. FLOATING PANEL section through louvered ceiling showing details of supporting system for fluorescent units, T-bar louver grid, and side closures for panels.



SECURITY CONSOLE in bank police office receives and tapes (on two recorders) all signals from fire alarm and watchman stations, and all raid and security alarms.



SET UP FOR BIG FIGHT with movable seats placed around boxing ring to accommodate total of 19,000 spectators, arena is generally illuminated by high-bay metal-covered prismatic-glass floodlights variously equipped with 1500-, 1000- and 750-watt lamps. Note radio and TV booths above left balcony (Press booths on opposite side); also lowered scoreboard containing 16 ring-highlighting 1000-watt floods.

Electrical Highlights of the Los Angeles . . .

Sports Arena

Comprehensive lighting plan and control systems, flexible distribution of power, complete air conditioning and extensive facilities for press, radio and TV make this indoor variety center one of the nation's finest. Lighting, controls and wiring were by Stetson Electric.

By B. S. Seegel, *Chief Electrical Engineer, Welton Becker & Associates, Los Angeles, Calif.*

WHEN the 1960 National Democratic Convention is televised next July, a TV audience estimated well above the 100-million mark will be introduced to the new Memorial Sports Arena in Los Angeles. At that time, TV viewers may possibly note some of the design features related to comfort, convenience and safety of on-the-spot spectators. Hidden from the camera's eye, however, will be those many *electrical* features that make this indoor arena one of the finest.

Over 30 different lighting mediums are installed to obtain desired results outside and inside the arena. For general illumination indoor lighting is provided essentially by high-bay floods plus recessed fluorescent fixtures and incandescent louvered downlights, while exterior lighting is provided by a combination of roof-based and pole-mounted floods and spots, domed post-lights along walk-ways, colored floods for an ornamental fountain, plus local treatments to highlight entrances and ticket windows.

The arena is completely air conditioned by means of two centrifugal refrigerating units and 16 zonal units controlled both locally and from a central board. In addition, 350 tons of refrigeration equipment are used for the dual purpose of either refrigerating the ice rink or contributing to the general air conditioning in the building. Power and lighting distribution facilities include a 2-section main switchboard, three motor control centers, four power and lighting distribution centers, plus numerous functional gutter assemblies.

In detail, it should be noted that the high-bay interior floodlights are 1500-watt incandescent units having metal-covered prismatic glass reflectors supported by loop hangers. Fixtures are attached to Condulets, secured by safety chains and electrically connected with flexible vinyl-glass sleeving rated at 392 degrees F. Circuit conduits are installed beneath lower cords of roof trusses attached by beam clamps.

Basic spacing of these lights is in a 12- by 15-ft pattern, although additional floods and spotlights are installed along catwalks and above main-interest areas such as the boxing ring, hockey nets and basketball hoops. With this arrangement, general illumination in the order of 125 footcandles is provided over the entire central area, while 200-fc or more is concentrated upon local areas of greatest spectator interest.

As indicated by a photo of the general interior, this same high-bay fixture is also used above front-balcony seats, although spacing of units is increased progressively as distances from the area of action increase, and lamps are correspondingly decreased in wattage from 1500 to 1000 and again to 750. To provide illumination for the topmost dozen rows of seats, fixtures are recessed square 300-watt incandescent units equipped with Alzak reflectors, dropped lenses in hinged frames, and white enamel trim.

70-Ft. Tower Scaffold

To install fixtures above the high-bay central floor area, the electrical contractor, Stetson Electric Co., utilized a special 70-ft-high tower scaffold consisting of 21 vertical pipe legs; this rig tapering from a 24- by 40-ft base to a 12- by 36-ft upper platform. Each leg was fitted with a rubber-tired castor having a locking device to prevent movement except when the scaffold was being shifted intentionally by means of a drag cable attached to a motorized winch mounted on a 3-ton boom truck.

Control facilities for arena lighting includes use of preset platens that may be inserted into programming panel slots; contacts so made energizing 120-volt control circuits that in turn operate contactor groups in various remote lighting switchboards.

For safe movement of spectators when general illumination is dimmed or off, all aisle steps are separately illuminated by local fixtures installed on alternate sides of successive treads.

Lighting of the surrounding peripheral concourse likewise involves several basic treatments, including (1) recessed fluorescent troffers equipped with flat Albalite diffusing glass panels in hinged doors, individually-fused 430-ma ballasts and 8-ft slimline lamps operating at 277 volts, and (2) recessed round incandescent downlights with Alzak reflectors, flat trim plates tilted to conform with sloped ceiling surfaces, and annular baffles for shielding purposes.

Wingnuts Clean Saddlebolts

Since saddle hangers for the fluorescent troffers were positioned prior to the gunnite application of fireproofing and soft acoustical ceiling plaster, and since saddle bolts would therefore be clogged during the spraying process, preliminary thought was given to the possible (1) greasing of bolts prior to spraying, to prevent plaster from adhering to threads, or (2) covering of threads with masking tape, then removing same after spraying had been completed.

After some experimentation, however, it was decided to install wing nuts over each bolt; spinning them down to bolt shoulders prior to plastering, then spinning them off afterwards. By using power spinners, this method proved to be the fastest method considered, and this method was therefore adopted to clean bolt threads prior to the placement of reflectors.

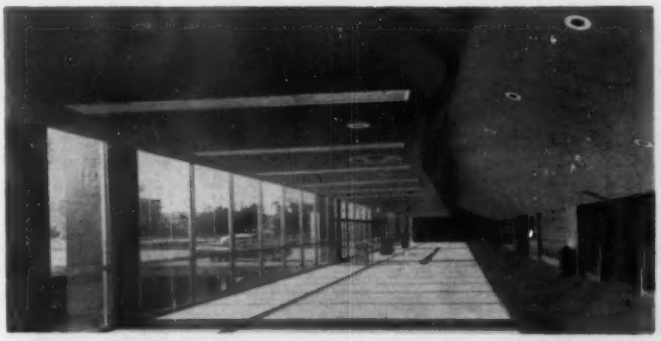
In addition to use of special rigs (such as the high-bay movable scaffold) and special methods (such as spinning wing-nuts to clean hanger threads), the electrical contractor also adopted numerous mass-production routines whereby lighting assemblies were pre-assembled at ground level in order to reduce "high time" related to installation. And, to simplify mechanics of mass production, he made extensive use of power tools (drills, saws and threaders), hydraulic benders, templates, jigs and "straddle buggies" (such as those used in lumber mills) to facilitate transporting and positioning heavy equipment such as transformers and switchgear.

To illuminate the arena's blue-tiled exterior wall, 500-watt floods with diffusing lenses are positioned on 12-ft centers along the outer edge of the circular roof-deck above the concourse; these units raised slightly above surrounding tar-and-graveled surfaces on JBs contained in waterproof-packed iron collars (see sketch).

In addition, the front facade of the domed roof is further distinguished by large translucent neon-backlighted letters identifying the Sports Arena, while batteries of pole-mounted floodlights contribute additional general illumination for walkways, entrances and plazas.

As noted in one of the illustrations, each floodlight assembly consists of six heavy-duty outdoor 1000-watt fixtures equipped with Alzak reflectors and slipfittings designed for formed aluminum brackets; one floodlight in each group of six being separately wired on an emergency circuit to maintain partial illumination in event of a main-service interruption. Floodlight standards are 35-ft tapered poles, capped and mounted on forged aluminum bases anchored to deep reinforced-concrete pedestals.

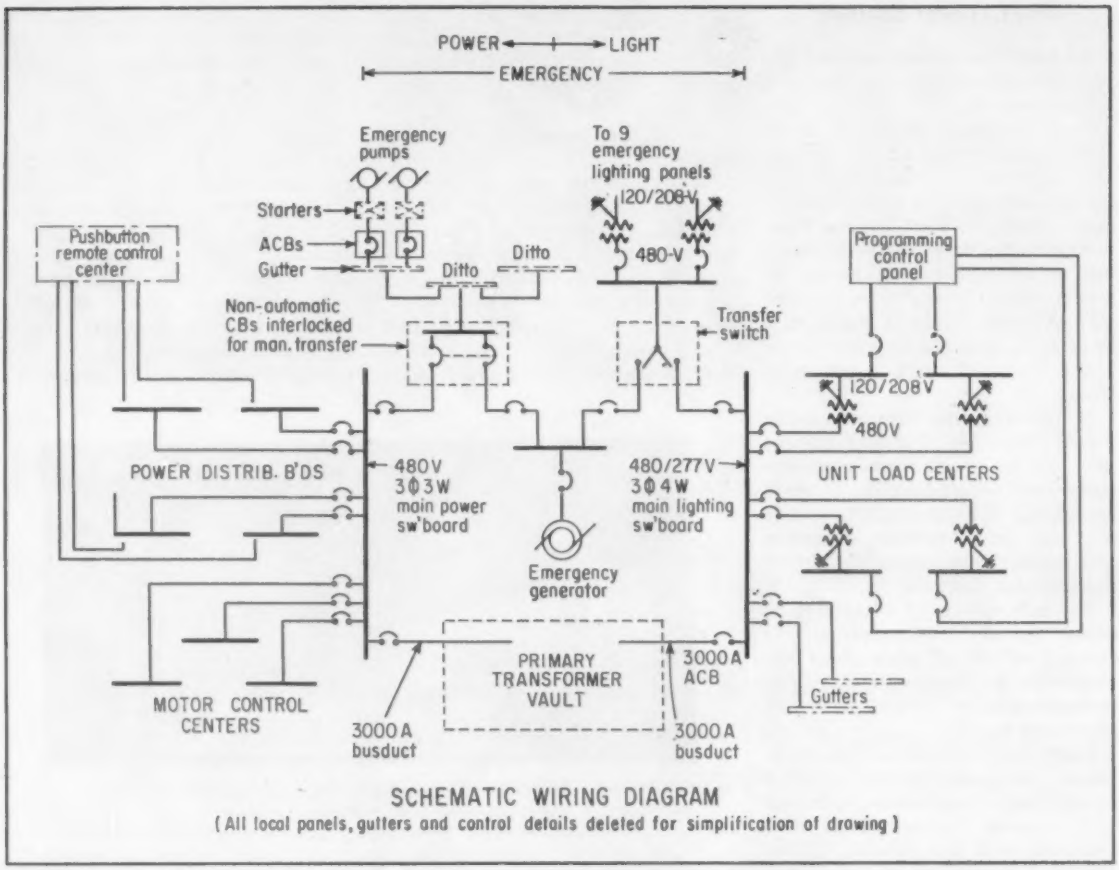
In addition to general illumination from tower floodlights, walkways are locally lighted by ornamental 500-watt post fixtures fitted with aluminum-collar reflectors and indirect domes mounted atop 10-ft galvanized and baked-enameled standards.



PERIPHERAL CONCOURSE surrounding arena is generally illuminated by fluorescent troffers equipped with diffusing glass lens plates in hinged covers, which are recessed in flat ceiling sections, plus incandescent downlights recessed into sloping areas beneath cantilevered balcony construction. Fluorescent fixtures are equipped with 430-ma ballasts and operate at 277 volts, while incandescent lighting is at 120.

Special Lighting

Completing the exterior lighting plan, (1) floodlight units, similar to those mounted along the concourse roof parapet containing PAR-56 lamps, are embedded in a central flagpole base, and are likewise positioned adjacent to arena walls rising from ground level; (2) downlights are placed above all-glass entrances and ticket kiosk windows for local highlighting; (3) surface-mounted fluorescent fixtures are placed between pre-cast bridge beams to illuminate lower exterior ramps, and (4) 20 separately-circuited floods equipped with varicolored lenses are positioned around a 40- by 60-ft fountain basin to further beautify the front plaza with a changing panorama of color projected upwards against seven water jets in varying patterns.

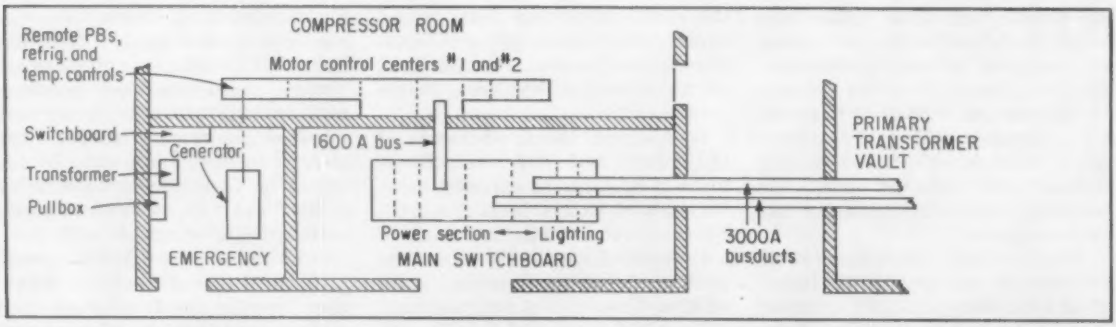


SCHEMATIC WIRING DIAGRAM indicates twin busducts between primary transformer vault and two sections of main switchboard; motor control centers and power distribution boards with related remote-control pushbutton panel; unit load centers and programming panel related to control of lighting; also connection of emergency generator, transfer switch, interlocked circuit breakers, separate bus structures and gutter assemblies.

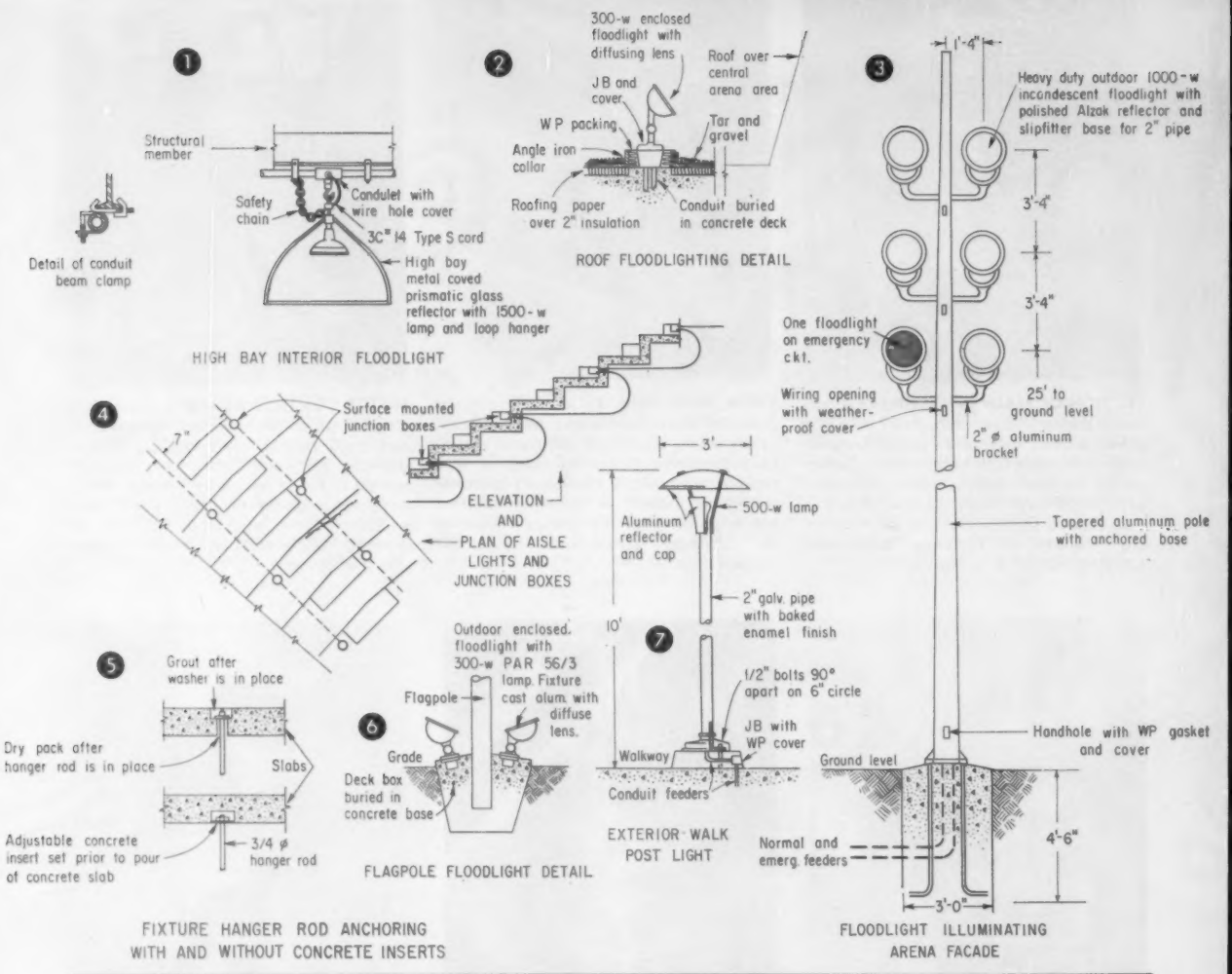
Utility service is initially received through underground concrete-sheathed non-metallic ducts; entry into the arena's 30- by 46-ft main vault occurring some 4 ft below ground level where duct casings are secured to the exterior wall by means of reinforcing tie bars, non-metallic ells then sweeping downward toward the primary breakers.

Voltage used in the building proper is 480 delta for power and 480/277 wye for basic lighting; current being carried from main transformer vault to a 2-section main switchboard in an adjoining room by means of twin 3000-amp busducts. Ducts are ventilated assemblies supported by spring hangers; busbars being triple-wrapped with VC tape, interleaved for reduced reactance, then rebent at terminals so that like phase bars may be grouped for common connection to electrically-operated ACBs.

The main switchboard is a free-standing metal-clad factory assem-



COMPACT ARRANGEMENT places primary transformers, main switchgear, emergency equipment, two important motor control centers and all compression equipment in close proximity in order to facilitate monitoring and prompt attention by watch engineer. Priority attention was given to continuity of electrical service to prevent panic.



OVER 30 LIGHTING TREATMENTS were included in the overall illumination plan; some idea of the variety being provided by these sketches of high-bay floods, staggered step lights for balcony aisles, two methods for securing fixture hanger rods to floor slabs, exterior floodlights on roof parapets and atop towers, local floods to illuminate walls and flagpole.

bly; individual cubicles being welded as self-supporting units, equipped with ventilation grilles and concealed-hinge doors, and served by a common ground bus for connection of enclosed apparatus and all non-current-carrying components. Power and lighting sections are separately equipped with WH meters, ammeters and phase-selector switches, while the power section is additionally equipped with kvar meter, ground detectors and related phase-indicating pilot lights. In both sections of the board feeder breakers are manual 3-pole ACBs with current-interrupting grids and trip-free operating handles.

Feeders radiating from the power section serve three motor control centers, four power distribution boards and one side of an emergency switchboard, while main lighting feeders extend to four 500-kva transformers related to 120/208-volt unit load centers, also to two main gutter distribution centers, plus the opposite side of the emergency panel. Total connected loads for power and lighting are almost identical; each 2800 amps.

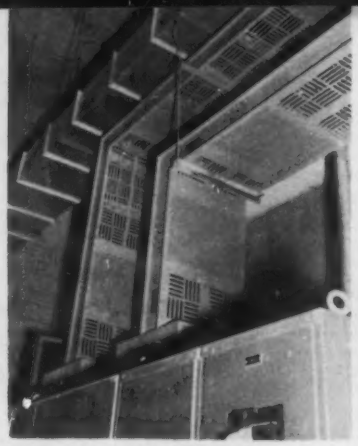
Largest single block of power is related to air conditioning compressors; one 200-, two 350- and one 150-hp 480-volt across-the-line electrically-controlled units being served from a 1600-amp bus in one of the MCCs. Several smaller compressors and unit air conditioners, plus supply, exhaust and cooling tower fans, boiler control panels and a variety of pumps sized between 75- and 25-hp comprise the bulk of the loading on the other two control centers.

All control centers are free-standing assemblies with horizontal and vertical bus structures arranged so that starters may be stab-inserted from the front. Bus connections are silver plated, bolted and braced to withstand short-circuit shocks in the order of 50,000 amps without damage.

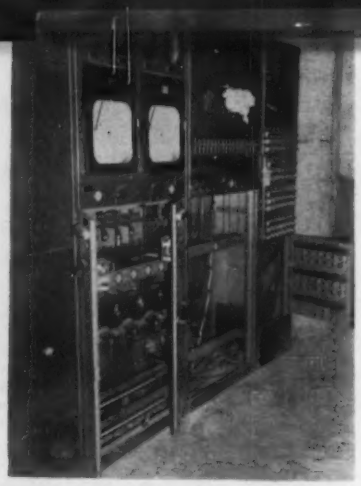
Motor starters are essentially combination units consisting of air-break magnetic contactors with associated thermal relays mounted on common chassis in cubicles, although other control combinations include manual starters with thermal overloads, pushbuttons, selector switches and/or auxiliary relays. Still other motor controls (gutter-mounted in functional groupings at 20 arena, concourse and catwalk locations and breaker-connected to the four previously-mentioned power distribution panels) include com-



SECTION OF MAIN SWITCHBOARD, pictured during installation, shows 480-volt power section (left) with feeder breakers related to power distribution panels, emergency transfer switch, electrically-operated 3000-amp ACB, ground detectors with related phase-indicating pilot lights, plus variety of metering equipment. Lighting section is to the right.



TWIN 3000-AMP BUSDUCTS connect 2-section main switchboard with adjacent utility vault. Ducts are ventilated assemblies supported by spring hangers, with triple-taped busbars interleaved for lower reactance except in terminal sections where phase bars are grouped together for common connections to circuit breaker lugs.



MOTOR CONTROL BOARD in compressor room includes refrigeration, temperature and gage panels, start-stop pushbutton stations with pilot lights, also breakers related to major secondary feeders. MCC, compressor equipment, utility vault, main switchboard and emergency facilities are grouped conveniently to promote supervisory efficiency.



FLUORESCENT TROFFERS for concourse are supported by pre-installed saddle hangers and bolts, threads of which were cleaned of sprayed acoustical plaster and fireproofing by means of wing-nuts which were spun up to bolt shoulders prior to spraying, then were spun off afterwards. Power spinners resulted in fast action.



HIGH BAY FLOODLIGHTS above central arena are 1500-watt incandescent units with metal-covered glass reflectors supported by conduit stems and loop hangers and insured against falling by safety chains secured to circuit conduits. Conduits, in turn, are secured to lower flanges of roof trusses by beam clamps.



RECESSED INCANDESCENT unit in slanting concourse ceiling beneath arena balcony seats has flat trim plate tilted to conform with slope of mounting surface so that axis of lightbeam will remain vertical. Alzak reflector provides punch for 150-watt lamps, while annual baffles minimize glare and spill-light.

binations of ACBs and mag starters, across-the-line magnetic units with thermal overloads, manual starters with OL protection, plus auxiliary PBs and selector switches to permit either local or remote operation. Motors in this general category are related to exhaust and supply fans, blast and strip heaters, pumps and fountain circulation, escalators and motorized doors.

Lighting load centers conveniently group secondary transformers and control panels in four insulated rooms at Concourse level. And, to confine operational noise and vibration within these areas, dry-type self-cooled 480-120/208-volt transformers are shock-mounted and rated below 56 decibels (measured one foot from casings).

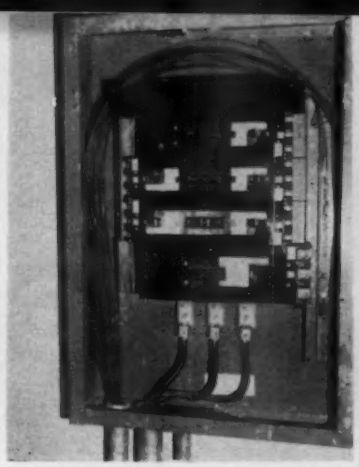
In addition, lighting contactors are mounted on sound-absorbent bases, with fire-resistant acoustic sound-deadening coatings applied to all interior surfaces of enclosures. Contactors, incidentally, are provided with 3-position double-pole rotary selector switches that may be switched off or set for either local or remote control.

Longest feeder run between main switchboard and any of the four 500-kva delta-wye unit load centers is 350 ft. And, with feeders consisting of two 500-MCM cables per phase, maximum VD in any feeder is only 0.87%.

Provisions for emergency power are unique in that 480-volt power and 120/208-volt lighting requirements are provided by a combined system that includes a generator unit, common bus, non-automatic CBs interlocked for manual transfer of power loads, a 3PDT transfer switch related to an emergency lighting bus, two delta-wye 480-120/



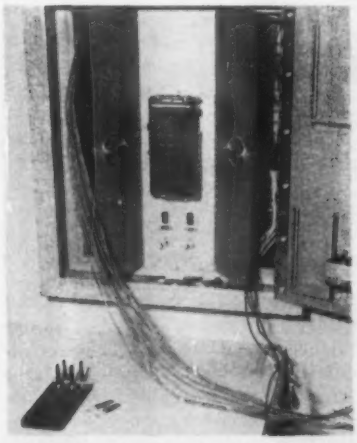
TYPICAL LOAD CENTER related to lighting distribution system is "package" assembly including 500-kva transformer, secondary 1600-amp 120/208-v 4-w bus structure, plus breaker cubicles related to feeders connecting with local control panels, low-voltage motor centers and remote programming stations. Insulation minimizes noise factor.



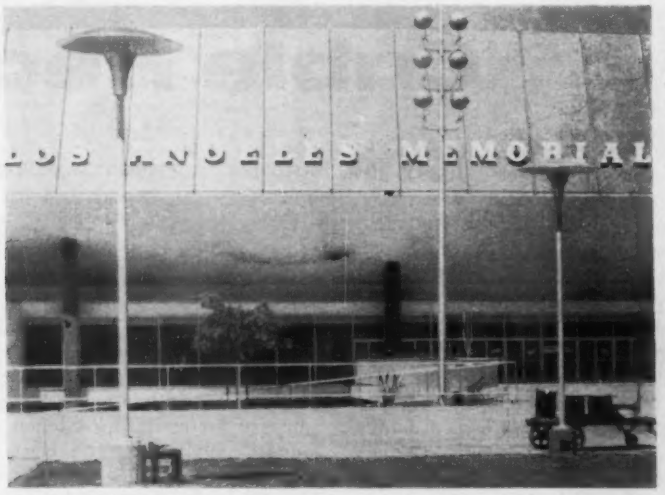
TYPICAL 480-V POWER has connected load of approximately 200-amps; is energized through 3-4/0 cables from main power switchboard in arena basement; has series of breakers related to door motors, escalators, gutter assemblies, air conditioning units and fans, and contains activating contactors remotely controlled from pushbutton on basement panel.



ADDITIONAL SPOT- AND FLOOD-LIGHTS, positioned along catwalks, are aimed at special-interest areas such as boxing ring, hockey nets or basketball hoops, thereby raising lighting intensities in these areas to 200-fc or better. Use of lipped channels for mounting purposes permitted luminaires to be suspended beyond edges of ventilation ducts.



CONTROL PANEL FOR ARENA LIGHTING utilizes bakelight platens and contact pegs which may be inserted in any desired arrangement to obtain preset programming patterns. Contacts so established energize 120-v control circuits that in turn operate contactor groups in various distribution panelboards.



FACADE OF ARENA carries translucent neon-lighted lettering for identification, while blue-tile roof is generally illuminated by series of 1000-watt pole-mounted floodlights; one light in each group-of-6 being separately circuited and connected to the emergency power source to insure partial illumination in event of main-service disruption. Ornamental 500-watt post-lights for additional walkway illumination are seen in foreground.

208-volt transformers, plus related breakers as indicated by an accompanying diagram.

Generator engine is a diesel unit with automatic starting and running controls, plus necessary electric kicker, starting battery and charger, transfer equipment, relays and automatic safety devices. Drive unit is multi-cylinder, capable of a 25% overload for a 2-hour period without overheating, also capable of picking up full load within 15 seconds. Alarms are provided to announce excessive water temperature, low oil pressure, overspeed, overload or failure to start.

The generator, providing 150-kw at 80% PF, is a rotating-field unit with shunt-wound exciter and static-type voltage regulator providing regulation within 2% of nominal voltage from no-load to 125% of full rated load.

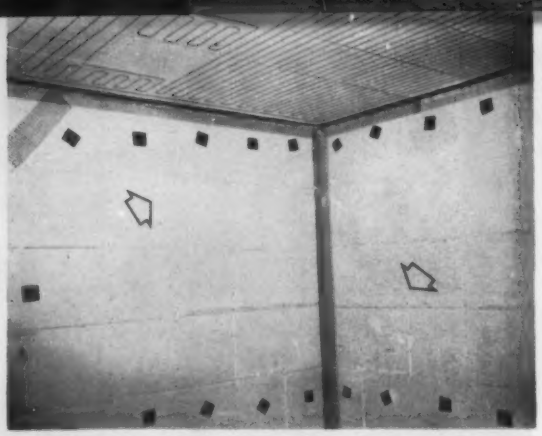
To provide coverage for all events, six permanent radio and TV booths are provided, with five permanent TV camera platforms located in key positions, and with local lighting, receptacle outlets and wiring gutters installed along 11 overhead catwalks that will permit complete 360-degree TV and photographic viewing of any area of possible interest.

The arena was planned and designed by Welton Becket and Associates; the electrical and mechanical facilities being designed by that organization's engineering department; Paul B. Sessinghaus, director, and Bud S. Seegel, serving as chief EE.

The electrical installation was by Stetson Electric Co., Los Angeles; Mike J. Boyak, served as project supervisor, with Jim Duff serving as job superintendent for project.



HEAT LOSS in the family-room that has 50 sq ft of glass plus an outside door and a fireplace was high. To overcome this, design calculations dictated that heating cable runs be spaced on 2-in. centers over the room's entire ceiling. Average number of degree-days for Hartford City area is 5900.



OUTSIDE WALLS of the home are insulated with 4 ins. of cellulose wood fibre. After the entire house was lathed, the wood fibre was blown into the walls through 2-in. diameter holes (arrows) bored into each stud space both above and below horizontal firestops.

Case Study In Cable Heating

A Hartford City, Ind., installation combines sound engineered application with effective insulation.

INDIVIDUAL wall-mounted thermostats are the only visible part of the electric heating system installed by Hartford City Hardware, electrical contractors of Hartford City, Ind., in a new 6-room bungalow. Behind the installation is a wealth of good practice and application knowhow.



HEATING CABLE plus a combination fan and light unit are installed to heat, ventilate and illuminate main bath. Contractors have found that home-owners are sold on the fact that with electric heat it is possible to control each room's temperature.

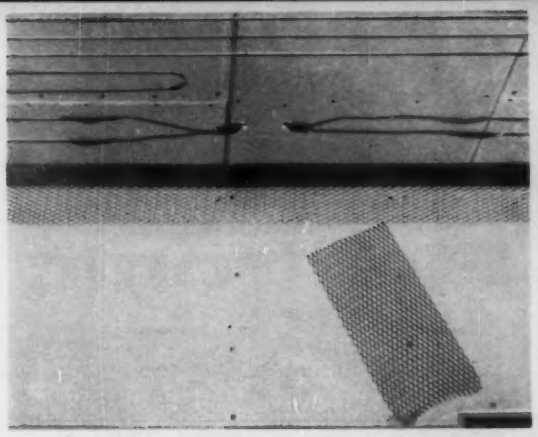
Step 1. *Service Entrance Installation:* In order to provide capacity for the 14.4-kw heating load and for all the home's lighting and general purpose outlets plus additional capacity for operating kitchen and laundry appliances, the electrical contractors installed a 140-amp, 110/220 volt, 3-wire service entrance. The main distribution center, fed by two parallel runs of No. 3 service entrance cables, is flush-mounted in a centrally located utility room that is adjacent to the home's kitchen-family room area. The 24-circuit panel is controlled by two 70-amp, 2-pole main breakers. Branch distribution is as follows: six 2-pole, 220-volt circuits for heating, one 2-pole, 220-volt circuit for fast-recovery water heater, one 2-pole, 220-volt circuit for free-standing electric range, one 2-pole, 220-volt circuit for clothes dryer, and six 1-pole, 110-volt circuits for lighting and general purpose outlets.

Step 2. *Installing the Radiant Cable Heating System:* Before the actual installation began, an accurate heat-loss calculation was made for each room to be heated in order to determine the amount of heating cable required. This is accomplished by using conventional calculation methods. (Manufacturers have manuals available for calculating and estimating purposes.) Insulation and ventilation necessitated by insulation (which will be discussed below) are also determined at this time.

After selecting each room's thermostat location, which in all cases was on inside walls away from outside doors, windows, and other non-average temperature zones, the electricians began laying out the heating job. First they marked off the ceiling 6 in. from all walls. Where the wire that runs from the thermostat location is at right angles to the regular runs, a 7½-in. spacing mark is made. Then using a narrow strip of wood as a marking gauge, the heating wire spacing (determined room-by-room in the original design considerations) for the home's entire ceiling is marked off.

The thermoplastic-insulated heating wire comes in fixed lengths with non-heating power leads. Each unit of wire is checked for continuity prior to installation. Installing the





METHOD used to connect heating cables' non-heating power leads with room thermostat. As can be seen by the above photos the non-heating power leads, protected by coverings of loom, are fed through the ceiling lath into the attic, then down between stud spacing to termination point in the thermostat junction box.

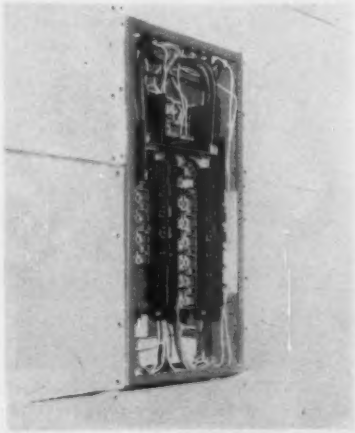
cable on the ceiling is easily accomplished by simply following the previously marked-off spacings. Staples placed not more than 16 in. apart hold the cable securely to the ceiling lath. In all cases the heating wire runs were made parallel to the joists so that the wire will cross lath boards.

When installing the heating cable near ceiling outlet boxes, recessed fixtures boxes and any other openings in the ceiling surface, a minimum clearance of 8 in. is observed. A good example of this may be seen in the right-hand photo above. The blank space on the living room ceiling illustrated was left free of heating cables in order to provide for a future air conditioning louver. This means an attic-type air conditioning system may be installed at any time the home owner may desire it without fear of disrupting the heating cable installation. Additional spaces for future air conditioning ceiling louvers are also provided in the family-room-kitchen area and in all three bedrooms.

After the cable heating system is installed on the lath board ceiling throughout the entire home, the system is checked for missing staples, checked for continuity and finally inspected by the local electrical inspector. When the first coat of plaster (normally called the brown coat) has been applied the ceiling is again checked for continuity.

Step 3. Installing the Insulation: This portion of the heating job was also accomplished by the electrical contractor. All outside walls of the home are insulated with 4 in. of cellulose wood fiber. The insulation is blown in after the entire home is lathed. The system used is similar to the method generally used to insulate existing homes. But instead of blowing the insulation through the outside framing of the house, it is blown in through the lath from inside the home. Holes, 2-in. in diameter on approximately 16-in. centers (stud spacing), are bored in the lath board at the top and bottom of all outside walls. A special nozzle is used to blow the insulation upward as well as downward until the stud space is uniformly filled. After this process is completed, the holes are covered over and the walls are ready for the first coat of plaster. There is little difficulty in gaining access to the spaces needing insulation, nor is there a problem of restoring the lath disfigured by the access holes to its original condition, since the lath will be covered with two coats of plaster. This method of installing insulation is of course impractical for dry-wall type construction. The 6 in. of cellulose wood fiber used to insulate the ceiling of the home is also blown in. A long flexible hose with sufficient force to cover large areas was used for this method. To effectively insulate the basement crawl space, a No. 4 Alfoil insulation was stapled to the bottom side of the floor joists.

To remove excessive moisture from the kitchen and the main bathroom, vent fans were installed. The kitchen unit is hidden in a hood mounted over the electric range. A combination fan and light unit is installed in the bathroom.



FLUSH-MOUNTED LOAD CENTER provides power for heating, cooking, lighting, water heating, laundry, etc. The power center has two 70-amp, 2-pole main breakers and 24-circuit distribution.

SCHEDULE OF HEATING LOADS BY ROOM

Living-room and bedroom hall	4200 w
Bedroom No. 1	1600 w
Bedroom No. 2	1200 w
Bedroom No. 3	1200 w
Powder-room	600 w
Main bathroom	1600 w
Kitchen	1600 w
Family-room and entrance hall	2400 w
Total heating load	14.4 kw

Maintenance of Electronic Equipment

Effective maintenance requires thorough training of technicians, provision of good tools and necessary instruments, up-to-date availability of technical reference material, accurate records and case histories of equipment being serviced, and practical schedule for following adopted routines.

By Lee Alvey, *Foreman, Electrical Maintenance*
AiResearch Manufacturing Division, The Garrett Corp., Los Angeles, Calif.

EFFECTIVE maintenance of electronic equipment is relatively expensive—and understandably so—because:

1) It generally is more complex than non-electronic equipment; therefore skills, basic education and intelligence must be of a high order to service such equipment.

2) Instruments and test equipment required for maintenance is both elaborate and costly.

3) Training of maintenance personnel must be extensive and intensive.

4) Records to be maintained are far more detailed, requiring more time to keep them up to date.

These several facts indicate that electronic maintenance can be costly, yet only by subscribing to a good maintenance policy can vital equipment be relied upon to give reliable, uninterrupted service.

With the objective of training our men to be versatile in their various fields, we conduct weekly classes for all maintenance electricians, discussing at these meetings circuitry and controls, operational problems, and routines for trouble-shooting. By so doing, all men in the department become familiar with basic theory related to electronic equipment, can therefore reason where trouble lies should operation become faulty, and can trace such faults by following a logical progression of test procedures.

This method of training has proved to be quite effective for, through discussion and analysis of wiring schematics in terms of basic circuits, men become familiar with the functions of the various components, their relationship to each other in an assembly, and the proper connection thereof. This same procedure of study is used for explaining test equipment, and, during our weekly classes, the men receive instruction in the functions and operations of such devices as



3-PHASE SPOT WELDER is periodically tested by maintenance electrician using modern test facilities, reference manuals, wiring diagrams and his own knowledge of the equipment. Versatility in electronic maintenance work is promoted through constant training and refresher courses developed by AiResearch.



CALIBRATION of voltmeter is checked in this instance by comparing Weston readings with a Leeds and Northrup type K3 as a reference. Maintenance of test devices, as well as of equipment tested with it, is the responsibility of the maintenance division in the plant discussed in this article.



BALANCING MACHINES, also spot welders, ultrasonic cleaners, induction heaters, all types of temperature measuring devices, many types of process furnace controls, plus the devices used for measuring and testing this assortment of equipment, is maintained by electricians working under the direction of the author.

oscilloscopes, oscillators, recording oscillographs and the like.

Maintenance on any item of either electronic or electrical equipment should start the day it is received, beginning with the preparation of a record card, entering all pertinent information, then determining spare items that should be included as inventory stock. The tentative frequency of maintenance routines likewise should be decided upon, and all information related to recommended operating conditions should be recorded for subsequent reference.

At the present time, our preventive maintenance program covers balancing machines, spot welders, ultrasonic cleaners, induction heaters, all types of temperature measuring devices, plus numerous types of process furnace controls related to heat treat, melting, carburizing and vacuum brazing furnaces. Maintenance of test equipment used in this work is also the responsibility of our department.

Tested Maintenance Procedures

General procedures of our program follow a standard pattern. That is, switches, control potentiometers and rheostats are cleaned and lubricated. Panels and similar equipments are vacuumed and cleaned, thorough inspection being made of all components at the same time. In this process, we look especially for discoloration of resistors, also signs of capacitor aging. It is not unusual to also find cold solder joints in control panels, or, in extreme cases, unsoldered connections that have been overlooked.

Filament voltages likewise are checked, while worn parts of relays are replaced, or complete new units are substituted. Vacuum tubes are also replaced when their mutual conductances fall below 60% of initial ratings.

Thyratrons are checked with industrial-type tube checkers that measure voltage drop across tubes. It is an interesting fact that tube life can be closely estimated and, by combining experience with past records, a good maintenance man can predict failure dates quite accurately. For example, we know that a good thyratron (such as tube type FG 95) should have a voltage drop across the tube of approximately 15 volts. Some manufacturers of tube checkers recommend



CONTROL CIRCUITS of a spot welder are discussed by electrical maintenance foreman Alvey with group of electricians in his department. Textbooks, typical problems and blackboard illustrations are combined in these weekly courses designed to keep maintenance men up to date.



PANEL DISCUSSIONS on controls and circuitry are related to typical inspection procedures and trouble-shooting routines. Knowing basic theory, the men can then intelligently follow logical sequences in locating and correcting faulty operating conditions.



DESIGN ENGINEER from manufacturer (Duncan Doane of Tektronik) disassembles and analyzes components of oscilloscopes to explain function of components, their proper relationship with each other and their connection in the assembly during class for maintenance men.

changing such a tube when voltage drop across the tube reaches 27 volts. We have found from experience, however, that these tubes remain serviceable until their voltage drop reaches 50 volts, and this higher permissible value makes a difference of from 12 to 18 months in usable tube life. Like all other pertinent data, this arc drop is recorded each time the equipment is inspected.

In the maintenance of balancing machines, our procedure is approximately the same, although, because of their critical importance, plate and grid voltages are reset to nominal values at frequent intervals. An overall check of this equipment is obtained by using an audio oscillator to create a known voltage of known frequency.

Maintenance of temperature control instruments includes thorough inspection for worn bearings and parts, defective contacts and generally poor operating conditions. Calibrations of instruments are made, and copies of these reports are submitted to departments using the equipment in question. Frequency of checking temperature control instruments varies according to their use.

Instruments controlling process furnaces are checked on a 90-day basis, while other temperature instruments, used in production or development test facilities, are checked more frequently. Since many of these instruments are higher-speed units, more wear can be expected on critical parts, such as slide wires and slide wire contacts. Greater attention also is focused on the 48-point switches in these instruments, since they are used hundreds of times a day and their wear is correspondingly severe.

These instruments are left operating continuously, although once a year we schedule a complete overhaul, including the dismantling and overhauling of motors and the flushing-out and regreasing of bearings. This is insurance against major breakdowns. And, since our department is also responsible for the maintenance of another test facility located 135 miles from our main plant, we have to depend upon high-quality preventive measures to eliminate unnecessary trips to that distant point.

Electronic Test Equipment

In checking electronic test equipment, tubes are checked with a good mutual conductance tube checker, and tubes falling below 60% of their rated mutual conductance are replaced. Another check is for microphonics or high noise level, voltage regulator circuits being tested and reset to manufacturers' specifications, and rectifier tubes being given an emission test by reducing filament voltage by about 10%. If tube reading falls 20%, tubes are replaced.



MAINTENANCE RECORDS, developed for each type of equipment being serviced, should be complete and up to date if data contained thereon is to be meaningful and useful. The above series of check-sheets for electronic counters, oscilloscopes, balancing devices and welding machines indicates variety of information to be included.

A check for sensitivity is likewise included, this being accomplished by varying the line voltage to the instrument between approximately 100 and 135 volts. If any weak points exist in the instrument, they soon will be spotted by this procedure.

In addition to the foregoing, we test for frequency response, linearity and balance, and, after findings have been entered in the records, a certification in the form of a service sticker is affixed to each instrument, showing date of service, or certification and date when the instrument is to be returned again to our shops for further service or checking. These several procedures may vary slightly according to equipment types, although general procedures herein discussed are relatively constant.

Techniques pertaining to calibration and servicing of equipment may be obtained from equipment manufacturers. In addition, we regularly send our men to service schools and seminars conducted by manufacturers. There the men are instructed in servicing equipment by factory-developed methods. And, by following these practices, we feel that anything leaving our shop can be guaranteed as meeting all basic specifications of the instruments.

In addition to maintaining electronic equipment, our department also cares for heliarc machines, automatic welding equipment, control valves, grinders and lathes.

In summing up, it may be stated that, to achieve effective maintenance, an industrial organization should—

1) Have maintenance technicians trained thoroughly regarding equipment they are to maintain.

2) Furnish these men with all necessary instruments and tools to do their jobs effectively.

3) Keep technical information complete and up to date, and make it readily available to all maintenance personnel.

4) Maintain accurate records so that case-histories of all equipment is meaningful and useful.

5) Place equipment on regular preventive maintenance schedule.

Only by keeping equipment operating on schedule at maximum efficiency can operating commitments be met and overhead charges minimized. This can be accomplished only through the medium of effective maintenance.

Dealing With Architects And Engineers

A number of pertinent suggestions for improving your business relationship with architects and engineers.

By Ray Ashley, *Research and Consulting Engineer, Oak Park, Ill.*

IN HIS daily dealings with architects and engineers, the electrical contractor takes it for granted that his methods cannot be improved. A review of many experiences gives us reason to think otherwise and conclude that a number of factors justify re-evaluation and careful study. These include:

1. Methods of presenting propositions.
2. Figuring and billing extra work.
3. Recommending changes in plans and specifications.
4. Protecting the architect.
5. Protecting the owner.

Propositions for electrical work were discussed at length in previous articles (EC&M, Aug. 1956, Sept. 1956). There we learned that, in bidding to architects and engineers, little was required other than the statement that the bid was "in accordance with plans and specifications." That holds true if the plans and specs are complete in every respect and there is no room for question. Should other conditions exist, how can the electrical contractor suggest changes without destroying his customer good will? Recommended methods of accomplishing this will be discussed later on in this article when we will learn what to avoid when writing such propositions for architects and engineers.

EXAMPLE I—THE INDIVIDUAL UNIT METHOD

(Price per Foot—No. 3/0 RHRW Wire)

	MATERIAL 1000 Ft.		LABOR 1000 Ft.
Base costs	$550.00	(45 hrs. @ $3.50)	$157.50
Shrinkage (mat.) 5%	27.50		.....
Insurances (labor)	.....	12%	18.90
Misc. & Direct Job Expense 2%	11.00	6%	9.45
	$588.50		$185.85
Overhead 10%	58.85	35% Base Labor*	55.12
	$647.35		$240.97
Return 5%	32.37	10%	24.10
Sell Price Material	$679.72		$265.07
Sell Price Labor	$265.07		
Total Sell Price	$944.79		
Sell Unit per 1000 Ft.		$944.79	
Sell Unit per Ft.	$0.94479	Use $0.95	

* NOTE—The 35% is not added to the insurance and the 6% direct job expense.

Estimating and Billing

There are three principal methods of estimating and billing "additional" electrical work. They are:

1. On the basis of "unit prices" as stipulated in the main contract.
2. At cost plus percentages of markup as stipulated in the contract.
3. In accordance with the contractor's standard practice (no provisions in the contract for billing extra work).

UNIT PRICES

Electrical specifications of architects and engineers frequently include a request for "unit" prices to be applied to extra work. These units are installed prices of so much per foot of conduit or wire, and so much each for outlet boxes, switches, etc. The contractor includes unit price quotations as a supplement to his bid for the main contract.

Architects justify their unit price request on the grounds that such information facilitates checking and provides better protection for the owner than other methods of establishing costs. Experience leads us to question both of these reasons as being generally true.

There are two general methods of preparing unit costs: 1) Figuring the individual unit; 2) Establishing a multiplier to be applied to all materials belonging in a similar group. Both are time consuming and involve considerable work.

Individual Unit Method. This involves normal estimating procedure to arrive at a unit price for a specific installation operation. Example I traces the development of such a unit for the installation of

EXAMPLE II—THE COMMON MULTIPLIER METHOD

Percentages to be used:

	MATERIAL		LABOR
Base costs	100%		100%
Allow for shrinkage (mat.)	5%		.....
Insurances (labor)	.....		12%
Misc. and direct job expenses	2%		6%
	107%		118%
Overhead markup. 10%	10.7%	35% Base. Lab.*	35%
	117.7%		153%
Markup for return...5%	5.89%	10%	15.3%
Totals	123.59%		168.3%

Multiplier For Material—1.2359, Use 1.24

Multiplier For Labor—1.683, Use 1.70

* Note: The 35% markup is not applied to insurances and job expense.

Applying the respective multipliers to the base material and labor cost for No. 3/0 RHRW Wire in example I, we have:

Material per 1000 Ft. $550.00 × 1.24	$682.00
Labor per 1000 Ft. (45 hrs. @ $3.50) $157 × 1.70	268.00
Total unit price (sell) per 1000 Ft.	$950.00

Unit Price per Ft.—$0.95—the same result obtained by method of Example I.

No. 3/0 RH-RW wire. Here there are 16 operations for a single item (not including discounts on material and extending labor). This method generally is used for special equipment such as motors, starters, relays, etc. It is common practice to set up a horizontal line of column heads, with a column for each operation. Such an arrangement for the material section of the estimating sheet might be as follows:

Col. 1. Name of item

Col. 2. List price of item

Col. 3. Discount to be applied

Col. 4. Purchase price

Col. 5. Miscellaneous and direct job expense (separate columns may be needed for cartage, hoisting, tools, etc.)

Col. 6. Total material job cost (Cols. 4 plus 5)

Col. 7. Overhead markup

Col. 8. Total (Cols. 6 plus 7)

Col. 9. Markup for return

Col. 10. Sell price (Cols. 8 plus 9).

Note:—Overhead and Return columns usually have two divisions, one for percentage and one for dollars.

Ten columns have been used for materials. There will be as many or more for labor. At times as many as 30 columns are used.

Common Multiplier Method. This method involves using markup percentages to establish multipliers that can be applied to base material and labor figures to get the unit cost. Example II shows how this can be done, then illustrates application of the multipliers to the base material and labor figures of Example I. The unit costs (for No. 3/0 RH-RW wire) figured by both methods are practically identical. The multiplier method is used for wiring items such as conduit, wire, outlet boxes, fittings, etc.

While the "multiplier" technique is simpler to use than the individual unit method, it still involves several calculations. Prices must be checked and discounts applied. The multipliers must be used. Separate calculations must be made for material and labor and the two results added to get the unit price. Then the prices must be written into the proposal.

Any way you view it, providing unit prices is a costly extra estimating burden the contractor must shoulder.

SPECIFIED MARKUPS

A contract with stipulated markups and a clear-cut statement of what is to be included as direct job expense simplifies estimating. Additional work is figured in the conventional manner using the specified markups. As ordinarily used, this is not the best form of contract, as it imposes the same markup on small "nuisance" orders as on sizable work. However, it does simplify the estimating chore, and requires no extra work for architects when checking. In the long run, this method should be fair to the buyer.

CONTRACTOR'S VARIED MARKUPS

The belief that contractors overcharge for additions and change orders has been a prime reason for the establishment of the unit price system. There may be some justification for this, but we do know that in many cases the "extra" or "change order" is little more than a "nuisance" so far as the contractor is concerned. Many endorse the belief that clearcut projects, with few or no additional orders, are far more desirable than those involving frequent changes and additions.

Some contractors' mistaken idea that the buyer has no right to know how the work is figured is a common cause for customer skepticism about estimates for "extra" work. The architect or engineer is given a price and is expected to accept it without knowing the detailed costs. The better contractors have long since learned that they have little or nothing to lose, and much to gain, by taking estimates to the buyer and acquainting him with the detailed costs.

The high costs (labor units and markups) of small orders have set up formidable barriers against acquainting buyers with estimating details. Varied markups and educational work on the part of the contractor can be used effectively to minimize the seriousness of these obstacles and acquaint the customer with the basic facts.

Slaves of habit that we are, there is a tendency to go on as we have in the past. We submit a price and hope it will be approved. Why not go to the buyer as soon as changes are contemplated, explain the costs vary substantially with amount of work involved, and submit a list of markups based on dollar volume? Such a list could be similar to that shown in Fig. 1. This indicates that markups must be considerably higher for a $300 order than for a $3000 order. A more detailed discussion of selecting markup to suit a particular job is found in a previous article "Billing Contract Additions and Changes" (EC&M, Oct. 1959, page 134).

To augment a list of varied markups, base costs such as $18.00 per 100 ft for ½-in. conduit and $20.00 per 1000 ft of No. 14 wire could be

submitted. These would serve as a guide for costs of all conduit and wire. Similar costs could be developed and submitted for other materials.

Should the architect or buyer prefer a uniform markup for all work, a markup for the average (estimated) job could be selected. However, chances are good that submission of a list of varied markups (based on dollar volume) would aid considerably in promoting a reasonable agreement and an amicable settlement.

There is a notable tendency to vary markups in 5% steps. Standard units of 15%, 20%, 25%, etc. are common for overhead with 5%, 10%, 15%, etc. being applied for profit. Seldom are figures such as 8%, 12%, 16% or 22% used. After striving so hard to keep material and labor base costs so accurate, it seems absurd to jump around with 5-unit steps for markups.

If a contractor can avoid unit prices by getting approval of a list of markups, it is a definite step forward. Such an accomplishment reduces his estimating work, imposes no hardship on the architect and protects the owner.

Opportunities to do educational work are limited, and the contractor must judiciously bide his time. Perhaps the best opportunity is when contracts and orders for additional work are being negotiated. One can easily get an audience then, for the architect or engineer is interested in contractor costs when a specific project is under study.

At such times, contractors can bring to customers' (owner, architect, engineer) attention the numerous items that boost the cost of small orders. Briefly, some of these are:

1. Time required to get information regarding the work.
2. Estimating time out of proportion to dollar cost.
3. Cost of getting special material to the job.
4. Cost of supervision.
5. Interruption of other work for special jobs.
6. Regular work delayed while deciding on changes.
7. Cost of bookkeeping and billing.
8. Cost of supplying electrical installations are much higher than that for most other trades.

Remember, contractor statements are much more effective if substantiated by published data.

Recommending Changes

Architects and engineers prepare plans and specifications which represent their idea of what is best for the owner. A contractor wishing to recommend changes must use discretion.

In writing propositions, one must avoid suggesting changes without the approval of the architect or engineer. If suggested changes are included, it should be stated clearly that they carry such approval.

Keep in mind that owners usually see the contractors' propositions. If an owner sees suggested changes, he may conclude that his architect has not specified the most suitable installation.

As a rule, it is well to approach the author of the plans and specifications with such questions as: Have you considered this—? Is there a possibility that the owner will want "this or that" in the future? Just how far one goes with recommending changes depends on his relations with the architect.

Architects have a high regard for some contractors and welcome their check on the plans and specifications. When estimating a job, a contractor can often detect omissions or shortages that are easily overlooked by the architect's office during final check.

Contact with the customer, or owner, is inevitable after a contract is under way, or alterations come up. At such times the contractor must be especially judicious and diplomatic about making recommendations. It is so easy to answer queries, then realize that the architect should have been consulted first. A good stock contractor answer in such cases is: "You had better talk to the architect. I do not know just what he has in mind."

Protecting the Architect

Although one hesitates to recommend changes in plans and specifications, sometimes this is imperative. Indicated or specified items may not comply with codes. Feeders or panels may not be up to required capacity. Some items inadvertently may have been overlooked. Unless the architect's attention is called to such errors or omissions when the job is being figured, corrections will prove costly later on. Should an owner learn of any shortcomings of plans or specifications, it can be quite embarrassing to the architect.

Close architect-contractor relationship can detect and correct these "errors" before customer confidence is damaged or lost. Such cooperation can and should be mutually beneficial and a safeguard for the owner.

Protecting the Owner

It is important that all trades and the architect work together closely so an original contract will provide a complete installation—without "extras." In the past, many owners have had the exasperating experience of completing their projects at a cost substantially in excess of the original contract price. In most cases, the basic reasons were the owners' laxity or inability to provide proper information to the architect; or making numerous changes after the work was started. Despite this, they often considered contractor's charges for "extras" excessive and held the architect partially responsible for the additional cost.

Some professional builders hire their own architects and engineers to provide a "complete" building service. They successfully stress the fact that they will give a guaranteed price for a completed project. This is no different from the long-established architect's guarantee—a price for a building including all work covered by the plans and specifications. There is

(*Continued on page* 267)

FIG 1—PERCENTAGE MARKUPS BASED ON DOLLAR VOLUME

DOLLAR VOLUME	PERCENTAGE MARKUP	
Base Cost of Work	Material	Labor
$100 to $300	20% & 10%	60% & 10%
301 to 800	15% & 10%	50% & 10%
801 to 1200	12% & 8%	42% & 10%
1201 to 2000	11% & 6%	36% & 10%
2001 to 3000	10% & 5%	35% & 10%

School Lighting

Requirements and Economics

Discussion of the new IES School Lighting Recommendations, and practical economic analysis of specific lighting layouts using various modern luminaires and light sources.

By John J. Neidhart and Theodore Ake, Jr.

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The Miller Company, Meriden, Conn.

THE recently-published 3rd Edition of the Illuminating Engineering Society Lighting Handbook includes new School Lighting Requirements that deserve attention and analysis. The cost of lighting systems designed to satisfy these requirements is also bound to enter the picture. In this article, the new requirements will be briefly discussed, and the economics of several different possible lighting systems will be compared.

Illumination Levels

As a result of the recently-completed researches of Dr. H. R. Blackwell, the IES Committee on School Lighting now recommends a minimum of 30 footcandles for reading published material and 70 footcandles for reading pencil writing. These values are minimum on the task in time and space. They are minimum in time in that the illumination at no time should be permitted to fall below the recommended value. They are minimum in space in that at least this much illumination should be provided at any point in the classroom at which the visual task may occur.

The "minimum in time" concept is recognized in the maintenance factors for typical types of luminaires published in the new IES Lighting Handbook. They are based upon the definition that Maintenance Factor is a depreciation allowance for design purposes relating the initial illumination and the illumination at the time at which it is anticipated that maintenance procedures will be instituted.

The concept of "minimum in space" presents a more difficult problem. The universally-used lumen method of calculating illumination gives the *average* for the entire area. The illumination near the center of the room or under the luminaires will usually be considerably higher than this average, and the illumination at the sides and particularly in the corners of the room will be considerably lower than the average. If, therefore, desks are likely to be situated in less-favorably lighted portions of the room, this should be recognized by providing an average level that is sufficient to insure the required amount of illumination at any point in the room in which the task is likely to be located. Special precautions can also be taken to so locate the luminaires in some installations that illumination uniformity over the entire area will be improved. In this regard it is important that the published spacing-to-mounting-height limits not be exceeded and that luminaires be mounted closer to the walls than the frequently-used half-the-distance between units.

Comfort

A comfortable visual environment is just as important as adequate illumination. The most practical method to date of designing for visual comfort is to provide recommended reflectances on room surfaces and furniture and employ luminaires having a satisfactory brightness distribution. Table I shows the reflectances currently recommended by the IES Committee on School Lighting. It may be noted that a relatively low reflectance is recommended for the chalkboard to assure ease of seeing by maintaining a high brightness contrast between white chalk or writing and the board.

Until recently, luminaire brightnesses have generally been specified, measured, and reported as maximum brightnesses (the brightest square inch at any given angle). Various researches on visual comfort have indicated, however, that direct glare is a function of the average brightness of the luminaires rather than the maximum brightness. It follows, therefore, that any recommendations regarding luminaire brightness is determined by dividing the candlepower at any given angle by the projected area (in square inches) of all light-generating and controlling elements of the luminaire that would be seen at that angle. The result will be in candles per square inch but may be converted to footlamberts by multiplying by 452. Average brightness data is now being provided by many lighting equipment manufacturers.

Fig. 1 shows the easy-to-use, flexible recommended brightness limitations for the prevention of annoying direct glare published in the IES Lighting Handbook. To use this chart, one needs merely to plot for a luminaire being considered its average brightness (line D) at 10° angular intervals from 45° to 85°. This should be done for both the crosswise and endwise brightness distributions of the luminaire. If

TABLE I
RECOMMENDED REFLECTANCES* FOR SCHOOL CLASSROOMS

Ceiling	85%	(70–90%)
Window Wall	80%	(75–85%)
Other Walls	60%	(50–70%)
Trim	40%	(30–60%)
Floors	30%	(20–50%)
Furniture	35%	(25–40%)
Desk Tops	40%	(35–50%)
Chalkboard	15%	(5–20%)
Tackboard	40%	(30–60%)

*From Fig. 11-25, IES Lighting Handbook, Third Edition

all parts of the brightness distributions so plotted fall entirely below any straight line (line C) passing through 250 footlamberts at 75° and lying between the limitations lines (A and B) of Fig. 1, an installation of these luminaires in a room having the recommended reflectances should be comfortable.

Economic Comparison

To permit an extensive comparison of the relative economy of the many light sources, types of luminaires and lighting layouts that may be employed to light school classrooms, Table II was prepared. The comparison is based upon lighting a typical classroom 22 ft by 30 ft with a 10-ft ceiling height and having average reflectances of 80%, 30%, and 30% for the ceiling, walls, and floor respectively. The analysis was based upon a 2-cent energy rate, 1000 hours annual operation, and a 10-year amortization period. Complete details of the installations compared are given in the first few lines of Table II, and the lighting layouts are illustrated at the head of each column.

All direct luminaires in the comparison are assumed to be recessed in the ceiling, all direct-indirect units are assumed to be suspended 12 in. below the ceiling, all semi-direct units are assumed to be surface mounted, and all indirect and semi-indirect units are assumed to have an 18-in. suspension. No costs are included for the suspended ceiling in which the troffers would be recessed, but installation costs for all systems did include labor and material for wiring back to the panelboard, including panelboard components.

The primary comparison points in the cost analysis are:

(1) The total initial investment
(2) The annual operating cost
(3) The total annual lighting cost

The total initial investment is significant in that it shows the amount of money that must be raised to make the installation. Unfortunately, this initial cost is frequently used as the sole means of comparing the costs of proposed installations, and the installations selected on this basis may actually prove to be the most expensive in the long run. A much truer comparison is given by the total annual lighting cost which includes the amortized installation cost and the operating cost. This annual cost will conform with the actual annual charges and expenses as they will appear in the financial records of the school. The annual operating cost itself is, of course, also important in that it represents out-of-pocket money needed to keep the system in operation.

To facilitate direct comparison of annual lighting costs, line 21 of Table II shows the relative annual lighting cost of the various installations with the least expensive installation having a relative cost of 100%. Even this, however, is likely to be misleading, for some of the apparently more expensive systems are really providing considerably more illumination. To determine the true economics of the various systems, the annual cost per footcandle for each system should be compared or the relative cost per footcandle may be used to show the results more readily. This has been done in lines 22 and 23 of Table II.

It is possible to use Table II to make many different comparisons, but a word of caution is in order to prevent unwarranted general conclusions being drawn from the results shown in this Table. The 10-year amortization period is fairly

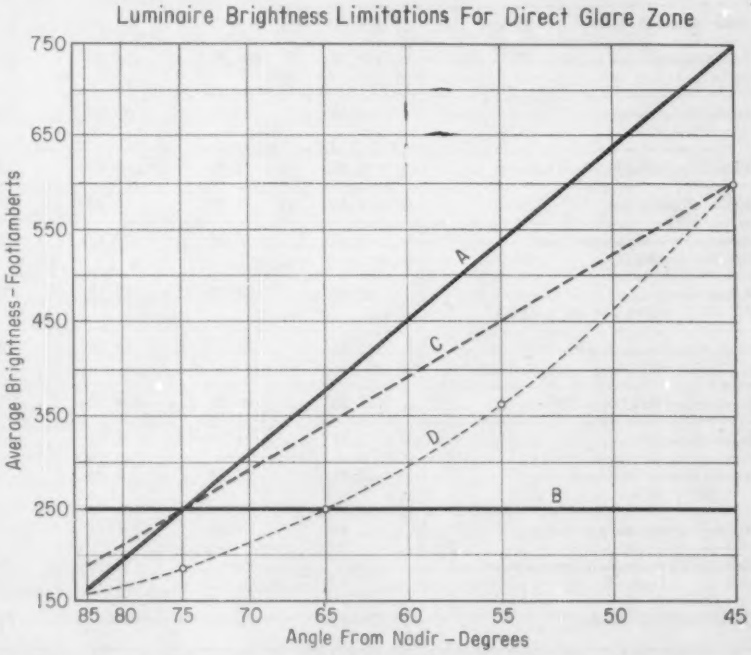
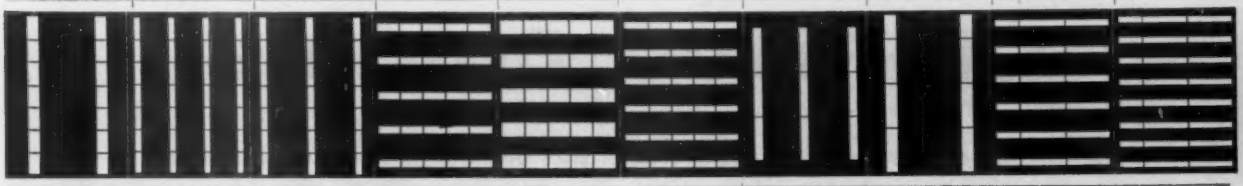


FIG. 1—Direct glare in fluorescent lighting installations providing 100 footcandles or less should not be a problem if two conditions are met: 1) ceiling and wall reflectances comply with Table 1 values; and 2) luminaires used have crosswise and endwise average brightness distributions which meet the limitations indicated in the above chart. An example is illustrated in the chart. The curve (line D) represents the average crosswise brightness distribution for a specific luminaire. It complies with the brightness limits established by the chart and by definitions; namely, that all parts of the curve (line D) fall below a straight line (line C) lying between the two limiting lines (lines A and B) and passing through 250 footlamberts at 75 degrees. Lengthwise average brightness should also be checked for compliance, but it need not fall below the same limiting curve (line D) as the crosswise distribution.

Table II—Cost Comparison of Various Lighting Systems

SYSTEM NUMBER	1	2	3	4	5	6	7
LIGHTING LAYOUT							
1. Type of lamp	Incandescent	◄ — — —

For A Typical School Classroom—22 Ft x 30 Ft x 10 Ft

8	9	10	11	12	13	14	15	16	17
									
——— ▶						SLIMLINE		HIGH OUTPUT	
——— ▶						F96T-12/CW		F96T-12/HO/CW	
Semi-Indirect		Semi-Direct	Direct 12″ Wide	Direct 24″ Wide	Direct 12″ Wide	Direct-Indirect Metal Side Panels		Direct 12″ Wide	
Plastic bottom		Refracting Enclosure	Refracting Closure		Aluminum 45 C × 22 L	35° Crosswise × 25° Lengthwise Louver		Aluminum 45° Crosswise × 22° Lengthwise	
4	2	2	2	2	1	2	4	1	1
11200	5600	5600	5600	5600	2800	11200	78400/row	18700/row	18700/row
188	94	94	94	94	47	178	1256/row	344/row	344/row
14	28	21	25	25	30	9	2 rows	6 rows	8 rows
2632	2632	1974	2350	2350	1410	1602	2512	2064	2752
53	52	62	66	80	47	54	82	57	76
$42.00	$42.00	$31.50	$37.50	$37.50	$22.50	$34.55	$52.10	$34.50	$46.00
855.00	1200.00	897.00	1000.00	1300.00	1163.00	601.00	694.20	1270.00	1690.00
813.00	1158.00	865.50	962.50	1262.50	1140.50	566.45	642.10	1235.50	1644.00
121.95	174.00	129.80	144.45	189.45	171.10	84.95	96.30	185.30	246.60
5.25	5.25	4.50	5.25	5.25	3.75	5.80	8.45	5.00	6.70
25.20	33.60	12.60	12.50	18.75	13.50	9.00	10.60	13.50	18.00
30.45	38.85	17.10	17.75	24.00	17.25	14.80	19.05	18.50	24.70
52.65	52.65	39.45	47.00	47.00	28.20	32.05	50.30	41.25	55.00
83.10	91.50	56.55	64.75	71.00	45.45	46.85	69.35	59.75	79.70
205.05	265.50	186.35	209.20	260.45	216.55	131.80	165.65	245.05	326.30
2.27	2.94	2.06	2.32	2.93	2.40	1.46	1.83	2.71	3.61
3.87	5.10	3.05	3.14	3.31	4.61	2.44	2.02	4.30	4.30
1.92	2.52	1.51	1.56	1.64	2.28	1.21	1.00	2.13	2.13
Yes	Yes	No	No	Yes	Yes	Yes	Yes	Crosswire only	Crosswire only
Satisfactory	Excellent	Good	Excellent	Excellent	Excellent	Good	Fair	Excellent	Excellent

the assumed conditions can materially affect the overall results, particularly in the comparison of incandescent and fluorescent lighting. The relative economy of the various fluorescent systems will be fairly stable. It should also be noted that all of the systems are not directly comparable from the standpoint of lighting quality although all but systems 10, 11, 16, and 17 satisfy the average brightness limitations suggested in the 3rd Edition of the IES Lighting Handbook for both crosswise and lengthwise viewing. Systems 16 and 17 easily satisfy the requirements for crosswise viewing. The last two lines of Table II provide some basis for comparison of lighting quality from the standpoint of Direct Glare and Illumination Uniformity.

Table II may seem to be a little overwhelming if one attempts to use all of it at once. It is suggested, therefore, that only a few systems

(Continued on page 273)

Primary circuit control and protection with . . .

Oil-Filled Cutouts

A discussion of the application characteristics of modern oil-filled cutouts for economical and reliable switching, sectionalizing and overcurrent protection in high-voltage electrical systems.

By G. Fred Lincks, *Engineer, General Electric Co., Pittsfield, Mass.*

MODERN oil-filled cutouts are today being used as low-cost switching and protective mechanisms for an increasing number of industrial applications. This is due to the inherent advantages they offer in National Electrical Code approved indoor or outdoor applications and for applications in semi-hazardous locations.

The oil-fuse cutout is a completely-enclosed assembly with a fusible element under oil. The circuit is broken safely and rapidly by an internal switching mechanism which is made up of the fusible element in its movable carrier and two contacts which the carrier bridges in the closed position. With oil-filled cutouts, the entire operation of switching loads or interrupting high voltage currents is confined within a sturdy grounded metal housing.

By totally confining flame from arcs and all of the interrupting forces, even when short-circuit currents are well above the point of internal failure, these cutouts offer safe and quiet operation. This is always desirable, but in many modern industrial applications it is a definite requirement. Oil-filled cutouts are especially suitable where explosive gases or inflammable dusts may be present, where there is a chance of complete submersion, where severe atmospheric conditions, such as smoke, corrosive fumes, or salt air, are prevalent or when exposure of electrically live parts might be hazardous.

Oil-fuse cutouts are made in three major types (Fig. 1): (1) those for use when connected to open wiring, commonly called the overheat or pole type; (2) those for use on underground systems, commonly called the underground or subway type; and (3) those for connection between underground and open wiring systems, commonly called the pothead type. The major differences between these three types are the means for connecting the line wires to the cutout:

Pole-type cutouts have rubber covered leads from the housing terminals. In open wiring applications, the circuit conductors are spliced to these leads.

Pothead cutouts have a rubber-covered, insulated conductor from one terminal, for connection to an open-wiring circuit conductor, and a suitable sleeve for connecting an

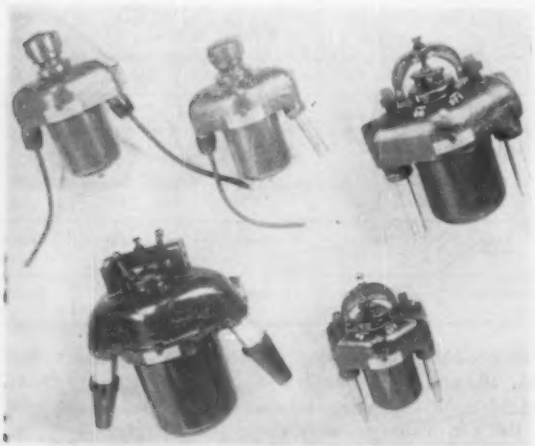


FIG. 1—Types of oil-filled cutouts: (Top L-R) pole type, pothead type and subway-type with separable sleeve bushings; (Bottom L-R) subway-type with nondetachable wiping sleeves and subway-type with separable terminals for rubber-covered cables.

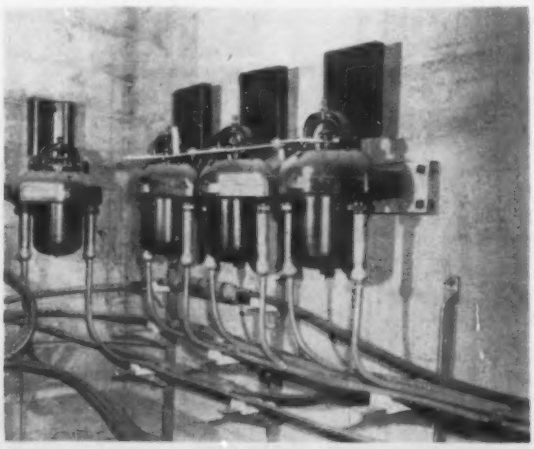


FIG. 2—Typical installation of subway-type cutouts in an underground vault. Units have separable sleeve bushings for wiping to lead-sheathed cables and are equipped with expansion chambers at their tops to secure full interrupting ability even under conditions of complete submersion.

underground lead- or rubber-covered circuit conductor to the other terminal.

Subway cutouts have suitable sleeves on both terminals for connecting lead-covered or rubber-covered cables in underground circuits.

Typical ratings of various types of oil-filled cutouts are given in Table 1.

Modern oil-filled cutouts provide effective switching of magnetizing and capacitive load currents, in addition to current-responsive circuit interruption of faults. For multiphase circuits, gang operating mechanisms allow two or three fuse carriers to be rotated simultaneously by mounting single-phase oil-filled cutouts together with a common external arm for opening or closing the circuit.

All three types of oil-filled cutouts are suitable for use in semihazardous locations. Although for greater safety, the subway type with its complete sealing gives positive assurance against a secondary explosion (external to the cutout) being caused when interrupting a fault current or when switching the load.

Underground Systems

On underground systems subway-type oil-filled cutouts (Fig. 2) are used for the protection and isolation of distribution transformers when a fault occurs either on the secondary lines or in the transformer. Also, the cutouts can be used for either manual or current responsive sectionalizing of feeders and disconnecting of branch portions of the feeder. On radial feeders they are used at normally open tie-points between feeders in order to permit switching to a second source of supply, thereby maintaining service in emergencies.

The load-switching ability of the oil-filled cutout makes it a relatively inexpensive subway switch to sectionalize both radial and loop feeders, with the switching being done either single or 3-phase. This switching is accomplished through the use of either a gang-operating mechanism or a metal-enclosed assembly.

Oil-filled cutouts are ideal for switching underground capacitor equipment on and off the line. The subway-type oil-filled cutout is completely sealed and is applied with an expansion chamber to secure full interrupting ability. This makes the unit suitable even where complete submersion is possible.

Overhead Systems

Although the expulsion-type cutout is the prevailing type of fuse protection on overhead systems, pole-type oil-filled cutouts are used where quiet, flame-free operation is required or where 3-phase switching ability justifies the use of oil-filled cutouts. And another common use of oil-filled cutouts is for switching of lighting systems for sport or recreational areas. Pole-type oil-filled cutouts may be used for such application either as single phase or 3-phase installations. Mechanisms are available which permit mounting the cutouts at the top of the pole, but allow switching from the base of the pole. This mechanism can be padlocked at the base of the pole to prevent operation by unauthorized persons.

Between Underground and Overhead

Pothead-type oil-filled cutouts offer real economies by combining in one device overcurrent protection and switching and a means for transition from an underground circuit to the open wiring of an overhead circuit. Sectionalizing of the feeder at this point has very distinct advantages, as it aids in the quick location of trouble and definitely determines whether the fault is on the overhead or underground portion of the circuit.

Airports

At airports oil-filled cutouts very often are used at different parts of the field for the protection of transformers and other equipment and for switching this equipment on and off the supply feeder. For this application, the metal-enclosed assembly is often used, avoiding the need for an additional building, since all electrical connections to the cutouts and equipment can be completely metal enclosed to prevent access by unauthorized persons.

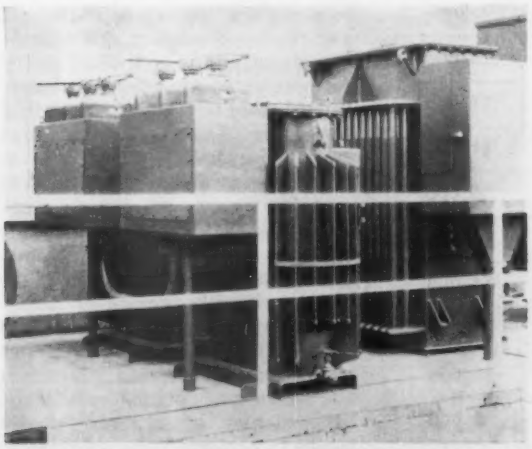


FIG. 3—Metal-enclosed cutout assemblies form the high-voltage terminal housings of these substation transformers. Units are equipped with gang-operated mechanisms to simultaneously switch all phases of the three-phase circuits with one operation.

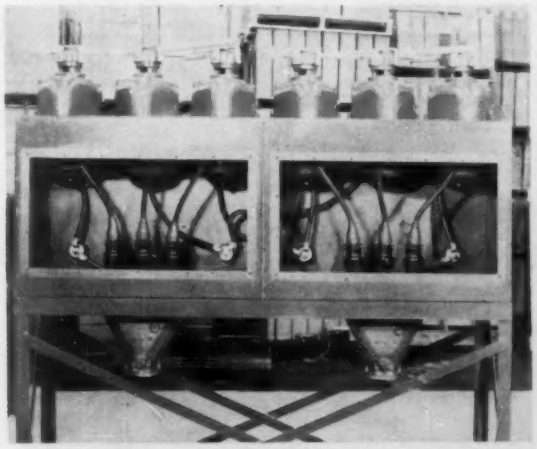


FIG. 4—Two 3-phase metal-enclosed cutout assemblies are joined together for combination switching. This arrangement provides ready sectionalizing of loop feeders, with mechanical or key interlocks, and can be used to connect the load to either of two sources of supply.

RATING CHARACTERISTICS OF OIL FUSE CUTOUTS

Oil fuse cutouts may be rated on the basis of a number of their performance characteristics as follows

1. Continuous current rating—the rms amperes which the cutout is capable of carrying continuously without exceeding a specified temperature rise. Such ratings for oil fuse cutouts are: 100, 200 and 300 amps.

2. Maximum design voltage rating—the rms volts at which the cutout is designed to be operated, based on ability to meet dielectric tests and interrupting tests.

3. Nominal voltage rating—the rms voltage rating of the highest rated typical circuit on which the cutout can be used.

4. Current interrupting rating—the maximum current, expressed in rms amperes and including the direct-current component (the asymmetrical short-circuit current rating), which the cutout is able to safely interrupt.

5. Rated making current—is the same value as the current interrupting rating. The oil fuse cutout has a making-current rating because it combines the function of load control switching with that of fault current interruption. It must be capable of closing against a faulted line.

6. Load break rating—the symmetrical rms amperes which the cutout is required to interrupt and close against, based on specified load-break tests.

Fuse links for distribution oil cutouts are rated in rms amperes based on the current which they are intended to be capable of carrying continuously when tested in the cutout of the lowest current rating for which the fuse link is designed. It is recommended that fuse links be selected with due regard to: normal and overload currents of the circuit; transient currents, such as transformer magnetizing inrush current, motor starting current, etc.; coordination with other devices.

In comparing time-current curves for coordination purposes, a value of 75% of the minimum melting time should be used to make allowance for most operating variables, such as preheating of the fuse link by load and normal variations in ambient temperature, and to prevent partial melting of the current responsive element (fusible element but not strain element).

TABLE 1—RATINGS OF TYPICAL OIL-FILLED CUTOUTS WITH INTERCHANGEABLE FUSE LINKS

For Applications to Typical Circuits

Type of Circuit	Circuit Voltage Phase-to-phase (Nominal System)	Voltage Rating of Cutout (Max. Design)	Maximum Current Rating of Cutout Amp	Interrupting Ratings Max. RMS Amperes At Max. Design Voltage
3-phase 3-wire Delta	2,400	4,500	100	6,000
			200	11,000
			300	11,000
3-phase Y or Delta	4,160	4,500	100	6,000
			200	11,000
			300	11,000
3-phase 3-wire Delta	4,800	5,200	100	5,000
			200	10,000
			200	10,000
3-phase 3-wire Delta	7,200	7,800	100	3,750

Industrial Systems

Most industrial systems are located in buildings where the expulsion of flame and arc gases and the creation of sudden noises cannot be tolerated. Oil-filled cutouts can be applied in industrial plants, especially those served directly from utility company systems, where the 3-phase short circuit power available is up to 50,000 kva. They protect service entrances with oil, askarel, or air-cooled distribution transformers and individual transformers or groups of transformers located close to the point of utilization (Fig. 3). They protect and sectionalize individual feeders or branch feeders. They also protect capacitor banks and motor branch circuits, and provide short-circuit back-up protection to industrial controls and motor starters on high-voltage circuits.

Oil-filled cutouts can be coordinated so the control equipment and motor starters provide protection and a means of automatic and manual switching up to their full capacity to perform these operations. However, faults causing excessive currents are cleared before the starters can be damaged.

(*Continued on page* 295)

An analysis of basic requirements . . .

Grounding and The NE Code

Effective grounding in grounded electrical systems involves skillful engineering to limit potential above ground and to clear faulted circuits. Here's a detailed study of this important subject, covering requirements of the 1959 National Electrical Code.

By Eustace C. Soares, *Industrial Engineering Services, Jersey City, N. J.*

PROPER grounding always requires an Equipment Grounding system; and, where a grounded power supply system is used, there must also be a Service Ground. Where both an Equipment Ground and a Service Ground exist there must be a point common to both systems. Both the Service Ground and the Equipment Ground must have low impedance (Sec. 250-51). *The location of the point common to both the Equipment Ground and the Service Ground is extremely important if the requirements of Sec.* 250-51 *are to be met in keeping the impedance sufficiently low to facilitate the operation of the overcurrent devices in the circuit.*

The two types of intentional grounds discussed here are:

(1) *Service Ground*

This is intentional grounding of one leg of the system, usually the neutral (Secs. 250-5 and 250-25). This grounding serves to keep the grounded conductor at ground potential at all times. The service ground connection should be arranged to provide the lowest practical impedance (Secs. 250-71 (c) and 250-92(a). The very important point here is that where metallic enclosures are used for grounding conductors, they shall be continuous from the point of attachment to cabinets or equipment to the grounding electrode, and shall be securely fastened to the ground clamp or fitting.

(2) *Equipment Ground*

Conductor enclosures and equipment shall be grounded for the purpose of preventing a potential above ground on the enclosures or equipment. Further they must be so connected and arranged as to provide the lowest practical impedance path for the flow of fault currents and must not limit the fault current below the value of the overcurrent protective device (Secs.

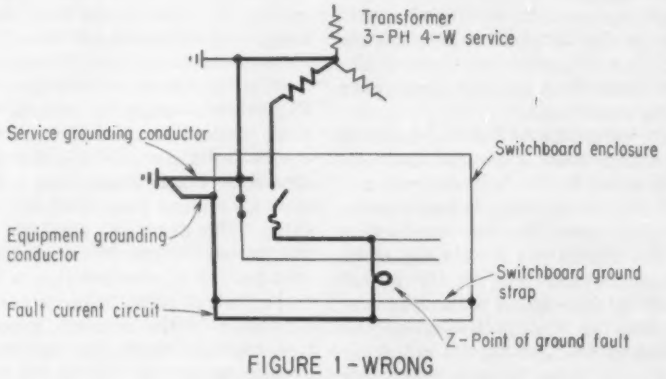


FIGURE 1-WRONG

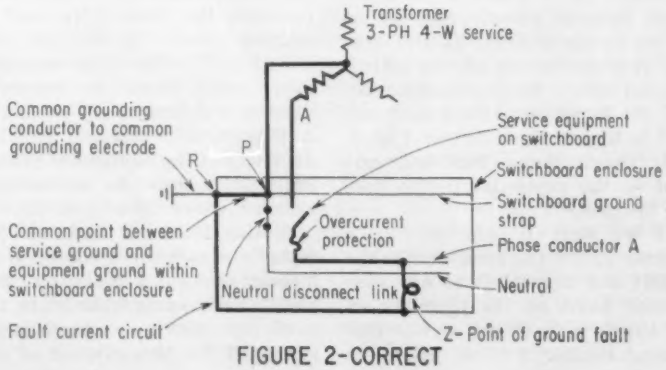


FIGURE 2-CORRECT

250-32 to 250-45, inclusive, and Sec. 250-51).

Basic Grounding

Two basic rules which assure a good grounding system are as follows:

1. The Service Ground and the Equipment Ground must have their common point of connection *within* the Service Equipment enclosure whether a separate Service Equipment is used or the Service Equipment is on the switchboard. ***A common grounding conductor*** shall be run from the common point so obtained to the grounding electrode (Sec. 250-54). See Fig. 1 and Fig. 2. Section 250-53 as now written, makes it optional whether a common grounding conductor is used for the service ground and the equipment ground or not. In other words, by inference, a common grounding conductor need not be used. This leads to many incorrect installations and actually poses some conflict with Sec. 250-51.

If we refer to Fig. 1, this installation meets the requirements of Article 250; yet a ground fault may not readily be cleared. This is not a hypothetical condition but refers to many actual installations. With a system such as Fig. 1, we have a good Equipment Ground and a good Service Ground; but we have a high-impedance Equipment Ground circuit, and a fault may not clear under many conditions.

By referring to Fig. 2, it can be seen that when a ground fault occurs as at Z, the fault current circuit will be as shown in heavy lines. In this case, the two conductors of the circuit are within the same enclosure, and provide the lowest practical impedance path. The connections in Fig. 2 best fulfill the intent of Sec. 250-51. On referring to Fig. 1, it can be seen that when a ground fault occurs as at Z the fault current circuit will be as shown in heavy lines. In this case the two conductors of the circuit are *not* within the same enclosure; and the impedance of the fault circuit is higher than that of Fig. 2. This impedance may limit fault current so the protective device does not operate.

If we were to add to Fig. 2 another grounding conductor to the circuit and connect it at any convenient point on the premises on the supply side of the service disconnect means, it would not affect

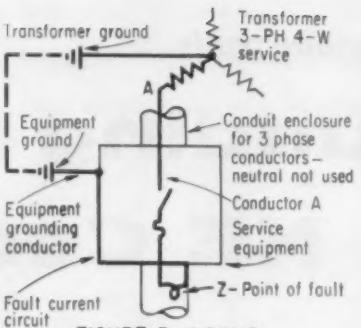


FIGURE 3-WRONG

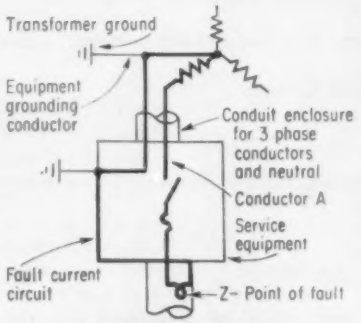


FIGURE 4-CORRECT

the safety of the circuit as shown in Fig. 2. It would be superfluous and would introduce additional cost without serving any useful purpose.

It is thus evident that Sec. 250-53, which permits the use of separate grounding conductors, might conflict with Sec. 250-51. But care should be taken to arrange a common grounding conductor as indicated. The grounded conductor of the system (usually the neutral, but irrespective of whether it is a neutral or not, provided it is a grounded conductor of the system) must be tied together with the equipment grounding system having the common point *within the enclosure* surrounding the phase wires and the neutral. (See Fig. 2, connection from P to R.) One of the most common faults found in grounding systems is failure to apply this rule.

2. Electrical continuity and conductivity of the equipment grounding system must be permanently assured (Secs. 250-71 to 250-78).

Section 250-1 (b) and (c) cover metallic conductor enclosures and metallic enclosures of electric equipment. Both paragraphs state that such conductive materials are grounded for the purpose of preventing a potential above ground on the enclosures or equipment. If those paragraphs were intended to cover only non-grounded systems they are complete and correct. However, whenever we refer to a grounded system these paragraphs become lacking in clarity because they omit one of the most important functions of such conductive materials which is to be able to carry a fault current and meet the requirements of Sec. 250-51.

Electrical continuity of metallic raceways throughout a wiring system shall be assured (Sec. 250-74). Such continuity is required for two reasons: one, to have a continuous good electrical contact through to the equipment grounding conductor; two, to provide an electrical circuit for the flow of fault current in the equipment grounding circuit back to the neutral such that the impedance shall be as low as practical to pass enough current to facilitate operation of the overcurrent devices in the circuit.

It is obvious that the metallic raceway in a system must thus be capable of carrying a fault current well in excess of the rating of the overcurrent device. All the joints in such a metallic raceway system must also be capable of carrying such a fault current.

Conductivity of Ground

Consideration should always be given to the subject of electrical conductivity as it applies to conduit and other metal raceways or enclosures for conductors. In the event of a ground fault, the conductor enclosure becomes one side of the fault current circuit and as such must have the proper conductivity to safely carry any currents liable to be imposed on it. Although that is an indisputable fact and is expressed in the same words in Sec. 250-51, there does not now appear any wording in the code to spell out what the conductivity of such conductor enclosures should be.

Metal raceways or other enclosures for conductors should have a conductivity equivalent to 25% of the capacity of the main. Where a metal raceway or other enclosure for conductors is used to carry several circuits consisting of cables, then the conductivity of such metal raceways should be equivalent to 25% of the sum of the capacities of the circuits within the enclosure or to the full capacity of the largest

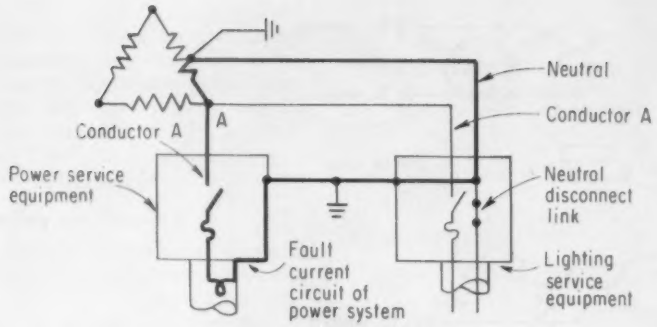


FIGURE 5-WRONG

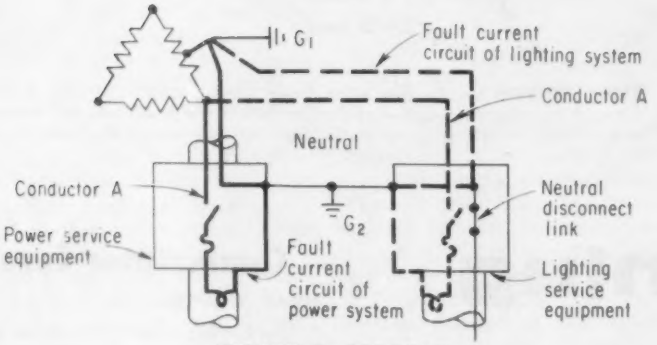


FIGURE 6-CORRECT

circuit, whichever is the greater. The sections of such metal raceways should be bonded together to obtain at the bond the same conductivity as required for the raceway or other enclosure.

An example is as follows: A 4,000-amp busway has a steel enclosure ⅛ in. thick and its perimeter is 48 in. Its cross-section is thus 48/16 sq in. Dividing by eight to get the equivalent copper cross section we have 48/16 divided by eight or ¾ sq in. The enclosure should have a capacity of 25% of the main or 1,000 amps, which will require 1 sq in. of copper. A copper bar not less than ¾ sq in. should thus be bonded to the side of the enclosure to obtain the electrical continuity and conductivity of the metallic raceway system.

If the enclosure is of aluminum alloy, after computing its cross section divide by 2½ to get the equivalent copper cross section. And if necessary, add sufficient cross section of aluminum bar so the sum of the enclosure equivalent copper cross section and the reinforcement is not less than 25% of the capacity of the main. The figure of 2½ is based on an average conductivity of 40% for the aluminum alloys commonly used for such conductor enclosures. It would be best if such reinforcement, to increase the conductivity of the metallic raceway, be installed by the manufacturer of the enclosure who would have the proper facilities to bond the reinforcing straps to the raceway at intervals not greater than 3 ft thus assuring good electrical continuity and conductivity.

Physical Connections

Other elements of effective grounding include the following:

1. The size of the grounding conductor shall not be less than given in the tables in the code under Sec. 250-94.

2. Always use a metallic underground water system for the grounding electrode, where such a system is available. If the main water supply is non-metallic but the tap from the main to the premises is a metallic system and the buried portion of the metallic system is 10 ft or more, it provides an acceptable ground (Sec. 250-81). However, such a ground should be checked to see if it complies with the maximum permissible ground resistance (Sec. 250-84). If such a grounding system does not meet the requirements of Sec. 250-83 or Sec. 250-84, it may be supplemented by one or more of the grounding electrodes recognized in Secs. 250-82 and 250-83.

Where the buried portion of a metallic piping system is less than 10 ft or does not meet the requirements of Sec. 250-84 and is supplemented by grounding electrodes, then the grounding electrodes and the metallic system shall be bonded together following the requirements of 250-94 as to the size of the bonding conductor.

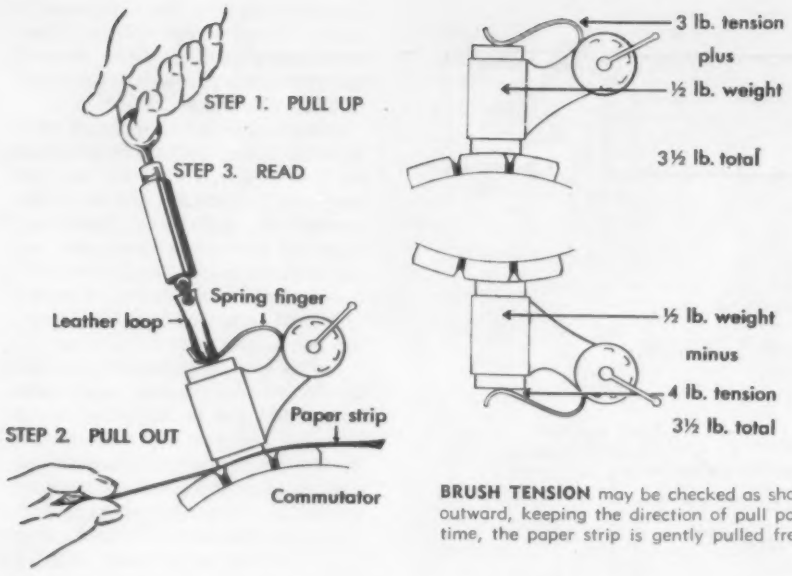
3. The size of grounding conductor for interior raceway and equipment shall not be less than given in table under 250-95. A part of the service grounding conductor as well as the equipment grounding system is a current-carrying conductor in the event of a fault. Sec. 250-95 recognizes that, and calls for an equipment grounding conductor which increases as the rating or setting of the overcurrent device increases in size. The equipment grounding conductor as required is approximately 25% of the rating of the overcurrent device. That is a practical size of equipment grounding conductor.

Sec. 250-95 does not now cover the size of equipment grounding conductors where the overcurrent device exceeds 1200 amps. However, since the equipment grounding conductor is a current-carrying conductor in the event of a fault and its capacity varies in direct ratio with the rating of the overcurrent device, it is practical, where the rating of the overcurrent device exceeds 1200 amps, to require that the part of the equipment grounding conductor which connects to the neutral be not less than 25% of the rating of the overcurrent device. That part of the service grounding conductor within the enclosure and which forms the common tie between the equipment ground and the neutral also is a current carrying conductor in the event of a fault and should have a capacity not less than 25% of the main service. (See Fig. 2, connection from P to R.)

Power Services

Sec. 250-51 on *Effective Grounding* appears to require some further clarification in the minds of many electrical inspectors. While this section is explicit, it does require some expansion if we are to be assured

(*Continued on page* 291)



BRUSH TENSION may be checked as shown using a scale. The scale is pulled outward, keeping the direction of pull parallel to the brush axis. At the same time, the paper strip is gently pulled free. At that instant the scale is read.

Maintaining Low-Voltage Generators

Practical hints on improving performance and extending life of dc plating generators through proper care of brushes and commutators.

By **F. K. Lutz,** *National Carbon Company, Div. of Union Carbide Corp.*

THE commutator surface of a low-voltage generator and the transfer of current from it to the brushes play a vital part in the satisfactory performance of the machine.

A new commutator is smooth and as truly cylindrical as the manufacturer can make it. Maintaining this condition as closely as possible over a long period of time involves scheduled inspections, cleaning, and a restoration of the commutator surface with special tools when necessary, plus adjustment or replacement of the metal-graphite brushes commonly used on this type of machine to withstand high current densities with a low contact voltage drop.

The following discussion outlines major considerations affecting performance efficiency with suggestions for its improvement.

Commutator Care

Hand Wiping

The canvas wiper is a useful tool for keeping the commutator surface in a clean, healthy condition. It is made by folding and riveting several layers of 6- to 8-oz clean, hard, woven canvas over the end of a pliable hardwood stick (about ¾ in. thick, 3 ft long).

In use, the canvas-covered end is pressed against the rotating commutator, the stick being moved slowly side to side so that the entire commutator area is covered. Following this procedure once a day will keep to a minimum the destructive effects of such foreign elements as dirt and corrosive vapors frequently present in electrolytic process installations.

Hand Stoning

When the commutator surface film becomes damaged and raw streaks appear or there are small burned spots, the hand stone may be used. Its underside should be formed to the same curvature as the commutator, with a span of contact greater than the broadest flat spots.

With the commutator running at full speed, the stone is pressed to the surface firmly and moved from side to side. Oil must not be used—it clogs the stone with copper. After stoning, the surface is finished with a fine grade of sandpaper, and both surface and slots are wiped clean of all dirt and copper dust.

On double-commutator machines *both* commutators must be stoned to prevent one freshly stoned commutator from taking more than its share of current and causing a serious load unbalance until a new protecting film is built up.

Grinding or Turning

When surface grooves, burns or flat spots cannot be taken care of by hand stoning, a complete resurfacing job is necessary—either by grinding with a surface stone or by turning down with a sharp tool.

Grinding may be accomplished with the armature in its own bearings or by removing it to a lathe or special tool built for the purpose. If it is left in place, the stone is clamped firmly to a holder mounted to the brush rigging. This eliminates the possibility of the stone digging into the commutator. Since low-voltage generators are not high-speed machines, the grinding may be done at full speed.

Special tools are also available for turning down the commutator with the armature either in place or removed. In either case, rigid tool supports and utmost care are required because of the critical setting of the diamond-point cutting tool. Maximum speed of rotation for this job should be about 600 ft per minute. The edge of the cutting tool should be slightly rounded to provide an overlap on each successive cut and not form a rough surface thread. Goggles and mask should always be worn to protect eyes and lungs from abrasive dust.

After either grinding or turning down, a finishing polish should be put on with a fine stone or sandpaper and the entire armature assembly whisked out with a high-pressure air stream.

Undercutting

Although operation of a machine with the mica flush with the commutator has the advantage of keeping the slots free of copper dust, the best and safest procedure is to keep the mica recessed below the copper segments. Flush mica doesn't stay flush long; the copper is softer and wears away faster, leaving the mica protruding from the slots. The result is sparking and bar burning, and eventually a resurfacing job becomes necessary.

Mica must be inspected often to determine whether it needs trimming. This may be done by drawing a penknife lightly along the bar edges; tiny powder particles mean high mica. A closer check may be made with a flashlight and magnifying glass. Held in close and beamed across the commutator surface, the light will show up the glitter of protruding mica fins.

Undercutting the mica can best be done with power tools made for the purpose, since cutting the recommended V-slots requires the actual removal of copper from the sides of the bars.

Centering the cutter accurately on the mica is one of the most important points in cutting a V-slot. If this is not done, all mica may not be recessed below the surface. After undercutting, a slight chamfer of the bar edges should be made with a scraper or slotting file to remove any burrs or sharp edges. Again, all copper chips must be blown or brushed from the slots.

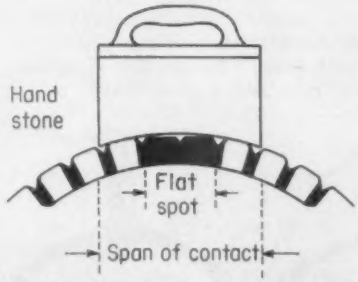


CANVAS WIPER made of folded canvas on a stick may be used to remove foreign deposits from the commutator.

Brush Care

Facing-In New Brushes

Adapting the flat contact surface of a new brush to the curvature of the commutator is desirable and recommended as good practice. Where brushes are to be mounted radially, the concaving operation can be done by the brush manufacturer. Facing-in brushes which are to be mounted slightly off-radial, however, can best be done right on the generator, since both bevelling and concaving are involved.



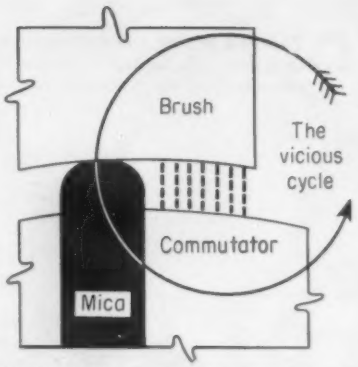
HAND STONE, used to remove raw streaks and small burned spots from the commutator, must have a span of contact greater than the broadest flat spots.

A good method of facing a complete new set of brushes is to cut a strip of sandpaper (No. ½—60 grit, heavyweight garnet paper is good) slightly wider than the axial length of the commutator and long enough to lap over ¼ of its circumference. This strip is placed around the commutator under the brush holders, the brushes installed under proper pressure so that their faces rest on the abrasive strip. The driving motor is very slowly brought to not more than half speed and then shut off. The sandpaper strip will be stationary, the commutator turning inside it. While the machine is slowing down, the sandpaper must be gripped by hand and turned in the direction of armature rotation to induce it to rotate with the commutator, repeating the operation several times if necessary.

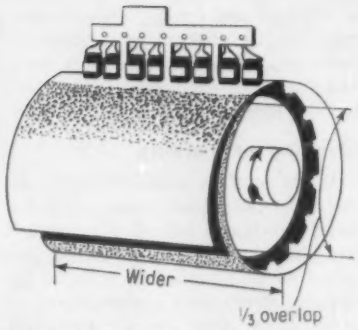
Then the motor is run between quarter and half speed until the brushes are fully seated. If the commutator has been freshly stoned, the set should be run at no-load or light-load with full field for about three hours to establish some polish on the commutator, after removing sandpaper and blowing out accumulated dust and grit.

A second method of facing-in new brushes permits the brushes to bear directly on the rotating commutator with simultaneous stoning of the

commutator. With the brushes in place and under pressure, a fine stone is worked back and forth across the surface for short periods of time (a minute or so). The brushes are pulled out and examined after each stoning until they are fully seated. Each brush should be removed as it becomes seated. After dust and grit is blown out and brushes are cleaned, the machine should be run at no-load or light-load for about three hours with full field.



HIGH MICA, exaggerated in this sketch, appears because of faster wear of the soft copper commutator bars—with sparking and bar burning as a result.



FACING-IN of new brushes may be done by operating the machine with the brushes bearing on rotating sandpaper or garnet paper.

Eliminating Dust

The relatively heavy particles of brush dust which build up around the brush holders and in the commutator slots through normal brush wear must be removed frequently. This dust has several bad effects: (1) it contributes to grooving of the commutator; (2) it becomes wedged between the brush and holder, reducing normal brush clearance and causing brushes to stick in the holders; (3) it produces noticeable ringfire around the commutator.

The most common method of removing the dust is blowing out the machine with an air stream. This may be objectionable if there are neighboring machines, electrolytic tanks or other equipment which may be adversely affected by the blown dust.

Hand wiping and brushing or use of a vacuum cleaner are alternate methods, although vacuuming is probably not quite as effective as blowing.

Correcting Selective Action

Unequal division of the current among the brushes, or "selective action," can be very damaging on low-voltage generators, where even the normal full-load brush current density is rather high. Overloaded brushes heat up quickly and begin to wear rapidly. If they get hot enough, the shunt cables discolor from oxidation, which permanently increases their resistance as well as that of the connections between the brushes and cables. Because of the increased resistance, the brush will no longer carry as much excessive current—probably not even its normal share—and the excess is shifted to the other brushes. The effect is cumulative, and eventually all brushes are affected. A brush having badly burned and discolored cables should be replaced.

Brushes may become selective for any one of the following reasons:

(1) *Mixed brush grades.* Different grades of brushes can have wide differences in resistivity and contact drop. Operating in parallel on the same machine, they will share the current unequally and wear out at different rates. Similarly, on a double-commutator machine, both commutators must use the same grade brushes.

(2) *Brush pressure.* Where brushes are operating at different spring pressures, those with the lowest pressures have the highest contact resistance and will not carry their share of the current. Each brush grade has its own recommended operating pressure.

Pressure may be measured using an ordinary 12-lb tension scale fitted with a small leather loop, as shown in the accompanying sketch, to get firmer contact with the pressure finger's tip. The tension should be measured to the nearest ¼ lb and the brush spring adjusted accordingly. Since manufacturers normally specify brush pressures in lb per sq in., the existing conditions may be checked by dividing the scale reading by the brush cross-section area.

(3) *Uneven commutator film.* When the normal commutator surface film is broken, becomes uneven, or develops raw streaks, the brushes encountering this condition will have lower contact resistance and carry a greater current. In addition, they will wear at a faster rate and groove the commutator.

(4) *Loose terminal connections.* A loose or dirty connection between the brush terminal and the brush arm introduces a high electrical resistance, and the brush will not carry its proper load.

Prolonging Life

The load carried by a brush determines to a large extent the rate of brush wear. Since brushes come in different sizes, it is customary to speak of the load current density in amps per sq in. of brush cross section rather than amps per brush.

In addition to checking the rated load, factors should be investigated which contribute local short circuit currents to the brush load, such as incorrect neutral setting, improper spacing of brush arms, and incorrect interpole strength.

Finally, maximum brush life can be obtained only with good commutator condition. A rough surface resulting from burned bars or flat spots contributes to abnormal wear.



BRUSH MOUNTING may be either radial or off radial. In both cases the brushes must be "faced-in" to match the curvature of the armature before putting full load on the machine.

All-Electric Model Home Wiring

A case study of a 1959 model home in St. Louis, Mo., whose wiring system design reflects adequacy-plus for today's and tomorrow's electrical needs.



UNIT HEAT PUMP INSTALLATION is simplified by a manufacturer's alterations of a standard window-wall component. In this example notice how the 4-ft wide panel is altered to provide a 2-ft by 4-ft framed opening for one of the home's six unit heat pumps.



METAL BAFFLE PLATE is attached to each heat pump's grill. The grill protrudes into the room only 3½ in. In order to make the baffles less noticeable they are painted the same color as the walls.

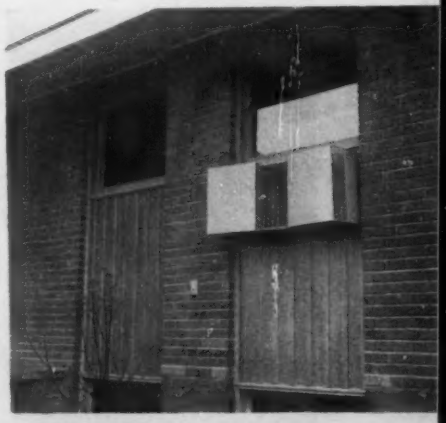
THE model home is much more than just a new home, rather, it is an experiment that puts many new products and techniques to practical use for the first time. The home has every electric convenience: an efficiently planned electric kitchen, including range, refrigerator, electric garbage disposal and dishwasher, an electric home laundry that includes washer, dryer and an electric water heater, and finally, complete electric heating and air conditioning.

Its contemporary wiring system designed for full utilization was developed in part around new techniques and methods that mean convenient and simultaneous use of all the home's electrical equipment, thus adding new dimensions to the standards for better living—electrically.

In order to see more clearly how the electrical system played such an important part in the overall functional design of the home, let's take a closer, step-by-step look at the entire installation.

Electric Heating and Cooling

The 2600 sq ft Preview House is designed around 6-unit heat pumps that heat and cool it. Using small heat pumps for heating and cooling is no new idea. But the units employed on this job differ from con-



EXTERIOR COVER surrounding the baby heat pumps makes the units less conspicuous and integrates them with the exterior fenestration.



WORKMAN is installing a section of the surface raceway system employed around the perimeter of all three of the home's bedrooms, plus the family room.



PLUG-IN MOLD installed at picture molding height provides unlimited flexibility for any desired plug-in lighting arrangements in this dual-purpose room.



BLANK LENGTHS of plug-in mold channeling (arrows) installed in dual-purpose room serve as exterior door trim and as raceway for feeders and switch-legs.

ventional reversible air conditioners. Basically here are a few features of the new units: a) They switch from cooling to heating and vice-versa by reversing the air flow instead of changing the evaporator coil to the condensor coil. b) Their coils have aluminum spines causing a greater heat-exchange area to be exposed to the air being drawn through the coils. c) Their rotary compressor is smaller than others of equal capacity. d) Their rotary fans located in the center of the coils move more air than propeller type fans used in many air conditioners.

The upper level of the home has ¾-hp heat pumps installed in two of its three bedrooms, while the living room and dining room both have 1-ton units. For the lower level 1 ton units are installed in the game room and in a general area of utility room.

Each of the heat pumps is fitted under windows, which was done for these reasons: a) From the outside of the house the units will look as though they are part of the fenestration, while on the inside of the house the units will be less noticeable under windows than if they were installed in a blank wall. The combination heating and cooling units protrude into the rooms only 3½ in. and are actually hidden from view by metal baffle plates that are attached to each unit's air supply and return grill. The baffles are painted the same color as the walls and are easily removed to permit repairs and adjustments.

Each of the (baby) heat pumps are individually controlled from a built-in control center located at the top of the unit. Installing the "test" model heat pumps was relatively simple. The estimated annual operating cost (St. Louis area) is about 12 to 14 cents a sq ft. Rate is 1¾ cents per kwh. Two important constructior factors that are instrumental in keeping operating costs down on any electrically heated home are extra amounts of insulation, plus double glazing—this job has both. While thinking in terms of costs also keep in mind that in this home there was no expenditure required for heating and cooling duct work.

In order to provide the ultimate in comfortable living, supplementary resistance type heating units were employed in critical air transfer areas and where extra warmth is desirable for rather short periods

of time. They are listed below:

Supplementary Resistance Type Heating Schedule

Upper level

Kitchen—baseboard type (1000 watts)

Main bathroom—combination type ceiling fan, heater & light (1,550 watts)

Front entrance hall—baseboard type (500 watts)

Master bath—wall type (660 watts)

Small bedroom—baseboard type (1000 watts)

Lower level

Dining area—baseboard type (1,500 watts)

Half bath—combination ceiling type fan, heater & light (1,550 watts)

6000 Watts of Lighting

The home's overall lighting program which is both functional and flexible is a combination of valance, cove, under cabinet, surface and recessed lighting. The lighting system, as well as the entire wiring layout was designed by Norman Raab, director of Union Electric's Home Bureau (St. Louis Utility). The installation represents a new look in lighting techniques with new uses of standard equipment that helps to solve the age-old problems of how to control and exploit light.

Briefly, here are a few examples of the various lighting techniques employed throughout the house:

Cove lighting, in the form of two 4-ft fluorescent fixtures is installed atop a storage unit that is used in one of the bedrooms as a room divider. Light, directed upward by a 1-in. by 3-in. baffle in front of the two fixtures bounces light off the cathedral ceiling providing the entire room with indirect illumination.

Coffer light, installed between joists, provides unique lighting effects in the lower-level family room. The joist space is painted white to reflect the fluorescent light; metal edging holds the plastic egg-crate diffusers in place. Between-joist lights are possible because heat pumps eliminate heating and cooling duct work and the need for a dropped ceiling to hide them.

Mirror lighting in master bath, is accomplished by a recessed fluorescent fixture built into vanity counter-top at the bottom of the mirror, and a recessed fluorescent unit built into the ceiling over the mirror. Both fixtures have plastic egg-crate diffusers that hide the lamps and provide a high level of well diffused illumination of excellent color quality.

Surface Wiring

Metal plug-in raceways are installed around the perimeter of all three of the home's bedrooms, plus the family room. The surface raceway system not only provides flexibility and convenience for plugging in lamps, TV's, radios, clocks, electric blankets, hair dryers, etc., but it also serves as the finished baseboard trim for each of the room's floors. Adding extra outlets to the system is easy, there is no cutting through plaster, touching-up or redecorating necessary.

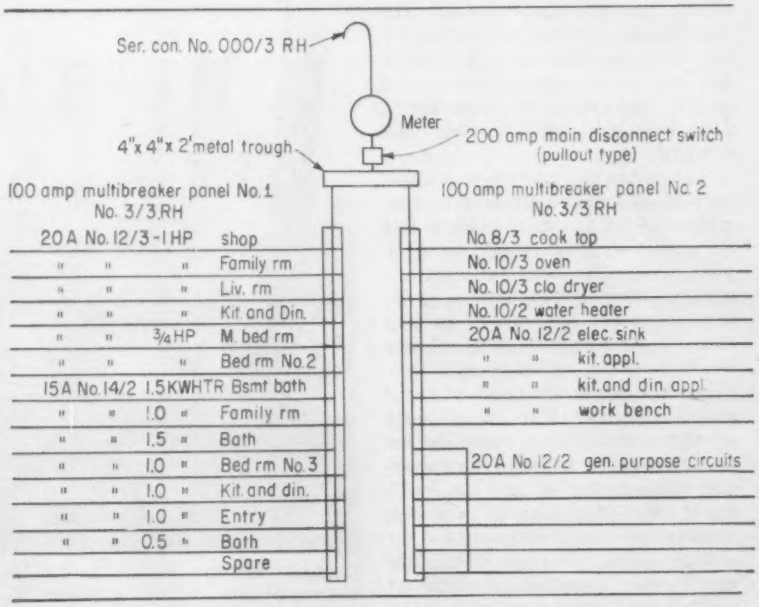
A new use of another type of plug-in mold strip is employed in the home's combination den-bedroom. Since the room will serve a dual-purpose, and because of its interior decor, lighting arrangements in this room were given a great deal of consideration. Plug-in mold proved to be the answer to all problems. By installing a plug-in wiring system (fitted with receptacles every 2 ft) around the entire room at door-head height of 6 ft 10 in., hanging and bracket type fixtures can be clamped onto, and plugged into the molding at any desired location to meet all furniture settings and lighting requirements. After the plug-in mold is painted to match the walls, it provides the same decorative touch as normal wooden picture molding.

To connect the room's baseboard wiring to the wall plug-in picture molding, blank lengths of plug-in mold are installed on each side of the room's doorway to serve as raceways. Actually the risers perform a dual function since they are also used as the door's exterior trim.

Because of the trend in home building to unit construction, housing of the future will probably come in panels—with the outside finish, insulation and inside finish complete in each panel. Therefore, surface wiring methods such as the ones devised for use in this home may well be the answer towards working with this type of unit construction.

Service Entrance

Service entrance for the Gold Medallion home wired by Hampton Electric Company of St. Louis, consists of a 200-amp main pull-out switch that feeds two separate 100-amp multi-breaker type panels. One of the two panels takes care of the home's heating and cooling load, while the second panel provides capacity for electric cooking, laundry needs, and other general purpose outlets.



ADEQUACY-PLUS for the home's present day requirements, plus capacity for future electrical growth, are reflected in the above distribution diagram.

HUMIDIFY

. . . With Radiant Energy

A new, trouble-free method provides the cost advantages of controlled humidity without the high maintenance costs of the old methods.

By Richard M. Smart, *Regional Sales Engineer, Lighting Division, Sylvania Lighting Products Inc., Melrose Park, Ill.*

AN INSTALLATION of a radiant energy humidifier, on which data are available, was made in the new office building of the Leich Electric Co., Genoa, Ill., in February, 1959. Design of the system was based on a survey of the building construction, the heating system, and an analysis of the available water supply. With the knowledge that health authorities agree that the correct humidity for human comfort should be 30% to 50%, the system was calculated for 72° F and 34% relative humidity. The two-story building has a floor area of 32,400 sq ft. Exterior walls are of faced brick and concrete block with 1-in. insulation, furring strips, and interior plastered walls. Ceilings are "Air-son" acoustic tile which provide air diffusion. The building is year-around air conditioned in ten zones with hot water heating coils, cooling coils, and supply and exhaust recirculation fans handling approximately 36,000 cfm.

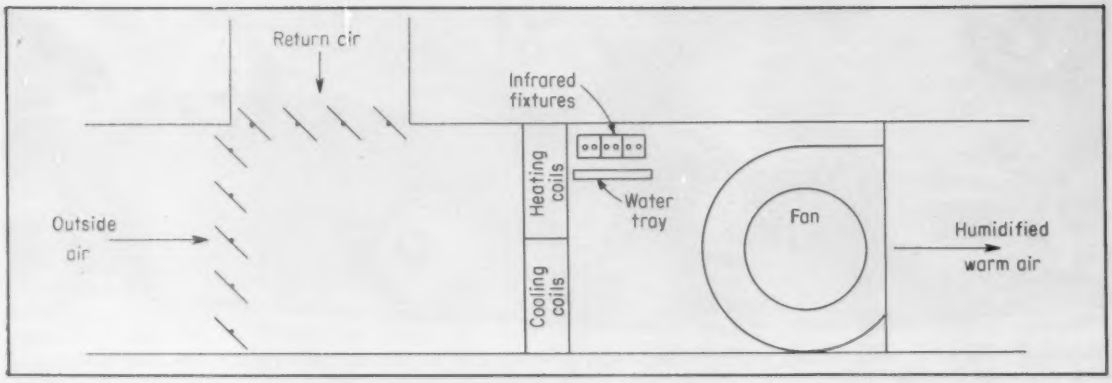
The water analysis showed hardness of 15.8 grains per gallon, consisting of 7.8 grains of calcium and 8.0 grains of magnesium. In addition, the water was substantially alkaline, having 14.4 grains of bicarbonates and 1.0 grain of carbonates. There were also small amounts of iron, silica, sulfates and chlorides. The water is typical of water supplies furnished in many parts of the country and could be expected to cause no more than average calcium and magnesium coating if exposed to heating or heated humidifier components.

The radiant energy humidifier which was installed consists of twelve 3000-watt, 480-volt T-3 quartz infrared lamps mounted in two banks of three Fostoria high-temperature gold-coated reflectors over shallow water trays. It is controlled by a return air humidistat which, for the month of February, maintained an average of 33.8% relative humidity within a range of plus or minus 2.3% at an average comfortable temperature of 71.8° F which varied only plus or minus 1.2°. The humidifier utilizes the same power circuit as the air conditioning compressor and is interlocked with the circulating fans. Water evaporation is 11.5 gallons per hour, of which about three quarts can be attributed to the surface evaporation of the trays. This can be compared with a room temperature varying from 74° to 80° F at 12% to a maximum of 20% relative humidity before the installation of the radiant energy humidifier.

Maintenance of the installation requires about one man-hour every two weeks to drain and flush the precipitated solids from the water trays, to clean the water inlet openings and to wipe the reflectors and dampers with a damp cloth to prevent reducing reflector efficiency, or the likelihood of a carryover into the air ducts of the loose residue resulting from surface "popping" of the solids during water evaporation. (A very thorough examination of ducts and turning vanes showed no visible evidence that solids reached farther than reflectors and dampers.) The precipitated solids from about 1600 gallons of water in this case amount to about one gallon of dry materials.



RADIANT ENERGY provides humidification for two-story, 32,400 sq ft area, office building of Leich Electric Co., Genoa, Ill. Humidifier consists of two banks of three reflectors each installed over shallow water trays, housing a total of twelve 3000-watt 480-volt T-3 quartz infrared lamps in Fostoria gold coated reflectors.



SCHEMATIC sectional elevation of duct system shows relative location of radiant energy humidifier, consisting of infrared fixtures, water tray and control equipment (not shown).

The total installation cost of the radiant energy humidifier in the Leich Electric Company office building was $1600. However, installation costs will vary, depending on capacity requirements, power availability, location of unit and controls, local labor rates, and building codes. Operating costs compare very favorably with those of other methods of humidification, and maintenance costs are only a small fraction of those required for other methods, since the latter depend so severely on the frequency of maintenance, the replacement of parts, and the labor for the much more difficult cleaning operations.

For many years, architects, engineers, building owners and managers, industrial executives and many other well-informed persons have recognized the importance of controlled humidity to lower operating and maintenance costs. They know that properly humidified air requires less heat for human comfort and efficiency, that it reduces absenteeism due to colds and other respiratory diseases, and eliminates the drying out of furniture and equipment and the consequent maintenance involved. Humidified air, they know, materially reduces static electricity and its costly effects on office machine operations, printing processes, etc., and prevents the shrinkage of materials that, in dry air, not only cheapens the quality of many types of products but also slows down or entirely prohibits the processing of products. The advantages of controlled humidity have been proved by countless installations in industry, hospitals, homes and offices.

Relative humidity, more often referred to merely as humidity, is the ratio of the amount of moisture in the air at a given temperature to the maximum amount of moisture that the air can hold at the same temperature. Air temperature must be considered because warm air can hold much more moisture than cold air. For this reason, cold outside air that is introduced into the heating system during the heating season becomes excessively dry when heated and mixed with air being recirculated, even when the outside relative humidity is high, so moisture must be added to maintain the proper relative humidity of the interior atmosphere.

Old Methods Costly

In the past, one of several methods of humidification has been required to add the necessary additional moisture, all methods having in common the disadvantages of somewhat rapid depreciation of efficiency over a period of operation, and high maintenance cost, unless chemically pure water is used. Since the cost of supplying pure water is prohibitive for most humidifier applications, the use of the best of whatever water supply is available usually is mandatory. Such water supplies contain solids and alkaline substances to a greater or lesser degree, depending on the geographical area, the principal offenders of which are calcium, magnesium, bicarbonates and carbonates. These chemicals all are objectionable in water that is used for humidification by any of the old methods because, when exposed to heat they cause the formation of a very hard, tenacious, coating that insulates heating coils and clogs nozzles, valves and filters. Unless frequently removed, this coating reduces humidifier efficiency and makes necessary the replacement of those parts that are vital to reliable humidifier performance.

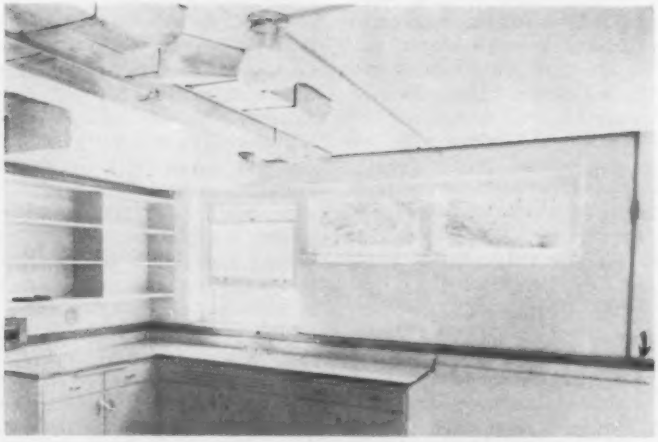
Aware of the limitations of all of the accepted methods of humidification, Warren C. Johnson of the Chicago office of the engineering and construction firm of Ragnar Benson, Inc., recognized an approach that is new, yet as old as the sun and the earth. Observing that the sun's radiation very effectively evaporates water from the earth's oceans, lakes, and rivers, yet leaves behind the solids and impurities, he set out to adapt nature's method to a smaller scale. After much calculating, very considerable experimenting, then more calculating, Mr. Johnson developed the method of humidification by radiant energy so that it may be applied to any size of building interior to meet any humidity requirement at any required temperature, within surprisingly narrow control limits of both temperature and humidity. As expected, the solids and impurities are precipitated out of the water as it is evaporated, and fall to the bottom in small loose granules. Mr. Johnson designed the Leich Electric Co. installation, based on this new method of humidification.

Due to the success of the radiant energy humidifier at Leich Electric, the new method has been adopted by the Humidaire Corp., Genoa, Ill., for 13 standard sizes. Through the use of combinations and multiples, an installation can be tailored to any requirement. The principle of the radiant energy humidifier has been proved over thousands of years. Why didn't we think of applying it long ago?



PENNWAY PLAZA—a public housing project in Kansas City providing 250 low-rent apartments in 42 multi-story buildings, all wired in surface raceways.

Low-Cost Apartment Wiring



SURFACE RACEWAY of baseboard type leaves circuit breaker panel on kitchen wall; provides grounded receptacles on 30-in. centers above work area back-splash; terminates in two switches (arrow), one controlling two kitchen lights, the other an outdoor light.



CIRCUITS leave kitchen panel to utility area at left (furnace and water heater). From junction box, conduits go up hollow apartment-dividing wall to bedroom ceiling lights; under stairwell to chair-rail raceway in living room.

Baseboard surface raceways increase wiring adequacy without boosting budgeted wiring cost.

COST limitations on low-rent public housing units need not restrict wiring to minimum code requirements. A realistic allotment for wiring, careful engineering and conscientious design cooperation between architect, engineer, electrical contractor and manufacturers' field engineers can provide reasonable wiring adequacy at minimum cost. How this was done on a Kansas City project now being completed presents an interesting case study.

The Project

Pennway Plaza in Kansas City is a Public Housing Administration project consisting of 42 multi-story buildings providing a total of 250 apartments. Of these, 152 are one- and two-bedroom units; most of the remainder are three- and four-bedroom units with a few of the five-bedroom size.

The project was designed by Tanner & Mitchell, Inc., Kansas

City architects and engineers. J. E. Dunn Construction Co., Kansas City is the general contractor. Evans Electrical Construction Co., Kansas City, is the project electrical contractor.

Building construction has a definite bearing on the wiring installation. Outside walls are of masonry block with brick and concrete block veneer facing. Walls between apartments are 8 in. thick and hollow. Non-bearing partitions within apartments are 2 in. thick; having a plaster board center with ¾ in. of plaster on each side. Ground and middle floors are of pre-cast concrete slab design. A wood-truss hip roof provides crawl space above the top-floor ceilings.

The Problem

This type of construction made installation of conventional flush wall outlets difficult and costly. No wiring could be concealed in the first floor or ceiling. The project architects allotted an average of $500 per apartment for wiring with an additional stipulation that they wanted as much wiring as possible for that figure.

How to successfully meet this stipulation was the problem faced by the electrical contractor, architect and interested manufacturers' representatives.

The Solution

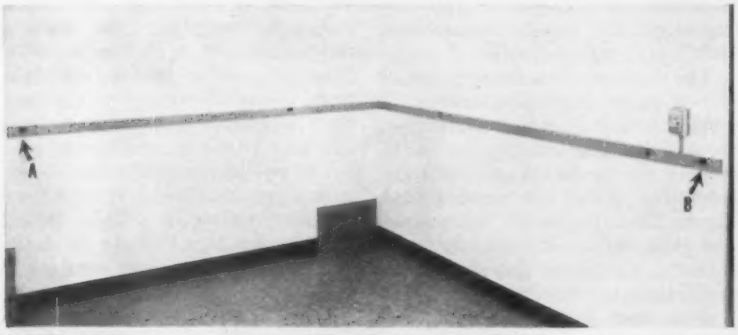
Considerable time and effort was spent by all concerned in layout revisions, cost estimates and comparative adequacy considerations. After thorough study, the architects decided that surface wiring was the answer to their problem. With PHA approval, they specified a surface metal raceway system throughout with particular emphasis on the use of baseboard-type units for receptacles in the kitchens, living rooms and bedrooms. No conduit system alternate was included.

A representative group of photos show how Evans' mechanics installed the surface raceway system. Of specific interest is the apparent adaptability of the baseboard unit as a plug-in strip above the kitchen work areas; as a chair-rail in the living room; and as conventional baseboard in the bedrooms. Also, the addition of switches to the chair-rail sections with special fittings eliminated vertical switch feeds.

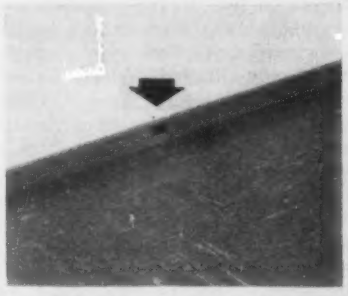
The Result

The surface raceway system provided more than double the amount of wiring (see receptacle chart) that normally goes into a PHA project. And the average contract price per apartment was $472—well under the $500 maximum. Even with the addition of a few "extras" caused by subsequent change in building design, the original budget figure was not upset.

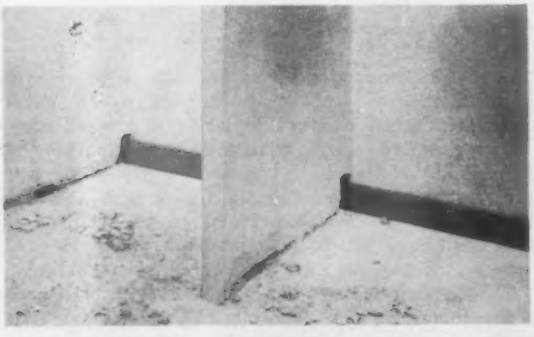
Net result of this thoughtful wiring approach to public housing projects is obvious. The architects got the most wiring possible for their budgeted dollars; the contractor got a good contract; and the tenants will reap the benefits of reasonable electrical adequacy in their low-rent apartments.



CHAIR-RAIL raceway in half of living room runs from door to door; has 3-wire duplex receptacles (one side hot, one side switched). 3-way switch (A) controls stairwell light; switch (B) at right controls half of each receptacle. Heater thermostat is above rail.



BASEBOARD raceways in bedrooms provide four to six duplex receptacles (arrow) depending on room-size. Same type raceway is chair-rail in living room. Molding houses bedroom light switch-legs and baseboard feeds.



PASSING THROUGH CLOSETS and walls, baseboard raceway continues from one bedroom to another. In all 2- and 3-bedroom units, baseboard was fed from only one location and was installed before floor tile was laid.

NUMBER OF RECEPTACLES PER ROOM

	Kitchen	Bed Room	Living Room
Standard PHA Specs.	2	2	3
Surface Raceway System Installed	6 to 7	4 to 6 (vary with size)	6 minimum 7 to 8 in most

13 *examples preach . . .*

Care In Use Of Meters

A roundup of actual experiences in the use of meters, pointing up the need for careful, knowing application.

By Samuel Heller, *P. E., Chief Engineer, Consolidated Electric Motor Co., New York, N. Y.*

TOO often the user of a meter or instrument does not know the limitations of the indicating instrument being read. The resulting deductions, based upon the visual aid, can be useless or harmful—both for the purpose and to the ego of the observer.

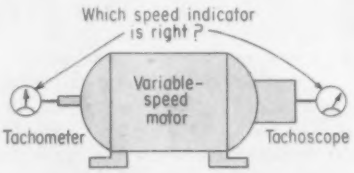
Most of the uses described in this article pertain to the maintenance or repair shop man—whose needs are varied, but whose experience is necessarily limited. Often he is called in when every "brain" in the shop from technician to engineer has tried to solve a vexing—and costly—problem.

The order in which the following problems are described has no bearing on their importance, frequency of occurrence, or misinterpretation.

1 A variable-speed motor—automatically speed controlled—is checked for speed and found to be too fast for a known setting of a dial. The motor had been removed for repairs and upon reinstallation the increase in speed had been noted. "What speed had it been running at before removal?" "The dial setting reads 1600 but it's actually running at 1685. We checked it with our very accurate tachometer. It's a laboratory instrument and new."

Actually no one had ever checked the motor speed before. "Why—it was new."

Upon testing with "his" tachometer, the repairman notices a peculiar action. The speed gradually rises to about 1730 to 1750 rpm and then quickly goes down to 1610 rpm, doing this about 12 or 13 times a minute.



"Our tachometer doesn't do that. Something's wrong with your instrument. I'll test with our *new* unit," says the customer.

The instrument is brought out—but it takes about six seconds to read it. First a button is pressed to zero it, then another button to release the needle. The needle rotates for about six seconds and stops. Then the meter is removed and read, the needle remaining stationary, indicating the number of revolutions per minute.

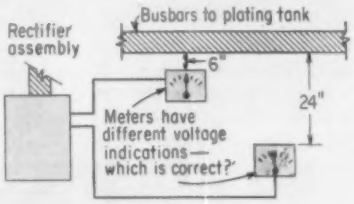
Both men were reading an instrument but the customer was wrong. The instrument he was using is a "tachoscope." It reads the actual number of revolutions over a fixed period of time and indicates them on the face of the meter in revolutions per minute. This is a very accurate form of indicating instrument; but for the type of load being measured, it was useless. This drive was held to a plus or minus 5%. It appeared to be controlled from the high side down, that is, it never went below the indicated speed (dial speed) but would drift upward until some kind of automatic control would bring it down again. The tachometer showed this, for a tachometer indicates "instantaneous" speed, whereas the tachoscope totaled the rpm over the time given.

This type of instrument (the tachoscope) should *not* be used on *pumps* with varying heads, or motors with rapidly changing loads (machine tools, etc.).

2 A large rectifier is moved to a more desirable place. The bus bars feeding a plating tank are relocated. "Nothing else is touched." The work was done on a Saturday.

Monday morning the plating foreman cannot duplicate the work done the previous Friday, with "exactly the same setting of the controls"—meaning the voltmeter and ammeter readings near the tank.

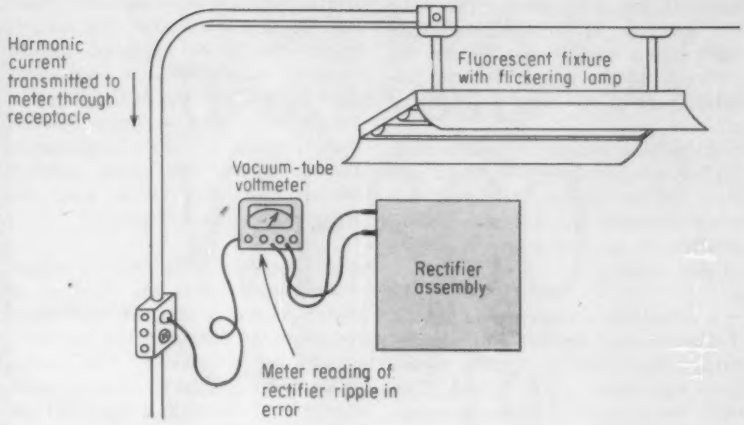
The electrician checks the installations and finally borrows a low-reading voltmeter. This meter reads *lower* than the one the foreman is using. Which meter is



wrong? Setting the output of the rectifier to the borrowed meter causes the plating to proceed properly. "The meter was damaged in the changeover." Yes—but why does it read *higher* than the borrowed meter?

In changing the meter location to suit the new bus bar arrangement the meter had been placed too near the bus bar. The magnetism of the bus bar influenced the *unshielded* meter. Moving it away (about 20 in.) from any bus bar made it read normal again.

3 In the same plant, it was decided to put in another dc ammeter nearer a new plating tank. A shunt was inserted into the 6-volt main bus bar line, and the ammeter placed about 30 ft away. Since an ammeter is only a millivolt meter, and carries only a fraction of an ampere, two No. 20 AWG wires were used as leads. Again trouble was encountered in plating—and after testing solutions, tightening bus bars, etc., the meter was checked in place. An error of nearly 16% was discovered, due to the very thin leads used between the shunt and the meter. Usually calibrated leads are used, or No. 12 wire should be used.



4 A new 50-hp slip-ring motor had just been installed. A resistor bank was used for starting only. The plant electrician with a new ac "clip-on" ammeter in his pocket was recording all motor currents as a comparative reference—as recommended by the local electric motor service shop. The 440-volt, 50-hp motor took 52 amps, but the rotor took zero amps under load. Something was definitely wrong with the hookup. The rotor volts as marked on the nameplate were 300 and rotor amps were 80.

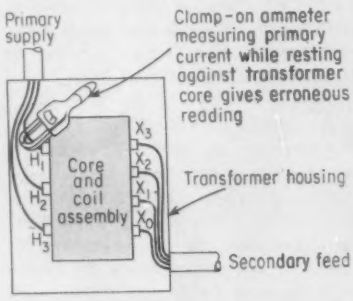
A hurried call to the service shop and, fortunately, a foreman who knew the answer.

At full load, the rotor slip is about 5%. At stand-still the cycles induced in the rotor would be 60 cycles. If synchronous speed could be attained the frequency in the rotor would be zero. At 5% slip, 5% of 60 cycles is induced—about 3 cycles. The clip-on meter cannot read at this low frequency. A dynamometer type movement which can read on dc or ac (as well as some magnetic vane types) should be used for this type measurement. With this type of meter, in the circuit the rotor current reads 66 amps—a reasonable figure.

5 A vacuum-tube voltmeter of recent purchase was very versatile. It had, among other scales, an rms scale which was used for reading the amount of ripple in volts in the output of some industrial rectifiers (selenium). The repair shop used this meter in lieu of an oscilloscope because it was so convenient to set up and operate. A rectifier unit in for other repairs showed, upon completion of repairs, a higher ripple than allowed. The capacitors in the rectifier were removed and new ones of the same value installed. The ripple still was much greater than required. After checking polarity of capacitors and finding it correct, the ripple suddenly returned to normal. Why?

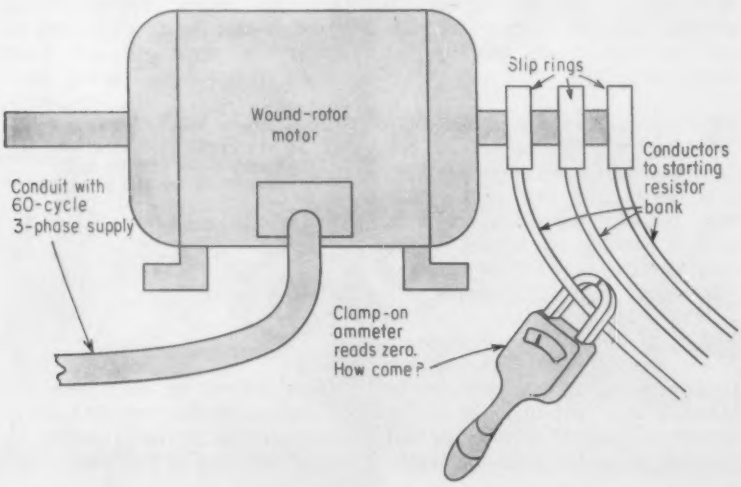
After some investigation, it was found that a flickering fluorescent lamp was sending a harmonic through the 60-cycle line into which the meter was plugged, so as to cause unusual readings. Installing the old capacitors and shutting off the faulty fluorescent fixture solved the problem.

6 A clip-on meter showed unusually high current in the primary of a transformer, yet the transformer did not show signs of heating. Several tests indicated a decided overload. The unit was shut down and



a serviceman called in to inspect the equipment before any damage was done. It so happened that the only accessible place to read the meter was through a small opening which necessitated laying the meter movement on the transformer core to reach the lead. The transformer leakage caused a reading without even opening the clip-on jaws. This value of current added to the actual transformer load produced a reading about three times normal.

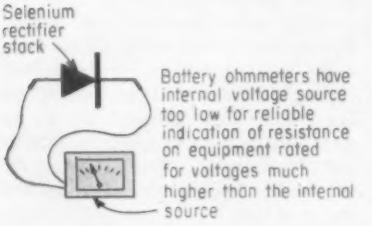
It is very important when reading this type of meter in any ac field to see if there is any reading



without the wire passing through the opening. If there is, the readings taken are useless. Move the meter away from this field on another part of the wire to read the current.

A more serious error results with higher frequencies—400 cycles and 800 cycles—where leakages are more common and are much more effective in causing errors in meters of any kind.

7 A selenium rectifier would not deliver the load marked on its nameplate. The voltage (120) would drop too much at full load. The leads were removed from the selenium stack and a self-contained ohmmeter was used to test the stacks.



The stacks were apparently good, as the ohmmeter showed nearly a short (very low ohms) in one direction and when the leads were reversed showed very high resistance. What could be wrong?

An ohmmeter usually has from 1½ to 4½ volts as a power source. A rectifier must be tested at or near its normal operating voltage or the test is absolutely useless.

8 A small direct-coupled motor-generator, ac to ac 60 cycles, is repaired and sent back to the customer—a laboratory. The laboratory notifies the repair shop that the generator is of no value because it will not produce 60 cycles—it runs at 1910 rpm. "How can an ac, 4-pole, 3-phase 60-cycle motor run at 1910?" asks the serviceman. "Maybe you mean 1710"—"No," is the answer, "we checked it twice."

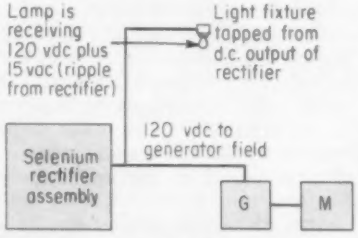
At the laboratory the serviceman is shown a "Strobotac," which measures rpm without contact with the rotating apparatus. The laboratory electrician is operating it—and it actually shows 1910 rpm.

The serviceman questions if the electrician had ever used this device before, and the answer is "No—but there's nothing to it. Mark the shaft, turn this knob until the shaft seems to stand still."

After some questioning, one of the laboratory engineers is called in. He first *calibrates* the instrument—which, he explains, should be done each time it's used—and then shows that the M-G set is rotating 1750 rpm—a more reasonable figure. (The tachometer showed nearly the same figure.) *Moral: Know how to use your instrument before applying it.*

9 A rectifier (full-wave bridge selenium) feeds the field of a motor-generator set. A voltmeter indicates the output of the rectifier, which never exceeds 120 volts. Since the rectifier is oversize, and conveniently located, a light fixture is tapped off the rectifier output and an ordinary lamp bulb inserted. The lamp so used seems to have an extremely short life and seems to burn with more brightness than normal. A check with another dc meter indicates that the one mounted on this rectifier is correct. What's the trouble?

A rectifier manufacturer is consulted. He explains that the exciter is only getting 120 volts, but that



the bulb is getting about 135 volts. He says that if they use an ac meter, dynamometer or even iron vane type, they can find the total voltage. "Total?" "Yes, the dc plus the ac ripple or component of the dc output which the exciter field does not see, but which the bulb accepts." Because of this high voltage the bulb burns brightly but with a short life.

10 A control circuit on a new automatic machine tool does not function. As the machine is a very expensive unit, the local repair man is requested to repair it as soon as possible. An inspection and reading of the service manual shows some static control (magnetic amplifiers). To hasten the repair, a long distance call is put through to the manufacturer. The engineer there requests that an ammeter be inserted at a certain point in the assembly to see if ac is being fed through one of the magnetic amplifier windings with the dc control winding open. The unit delivers 1.5 amps, so the repair man puts in a 5-amp ac meter and gets no reading. A new saturable reactor unit is ordered and received after eight days, and still the machine will not work.

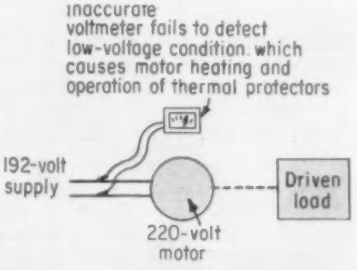
The repair man had not been told to expect values of 25 to 50 milliamps (.025 to .050 amp) which would, in most cases, not even budge the needle of a 5-amp ac industrial ammeter. *Moral: When asked to take readings, find out what should be expected.*

11 A small 230-volt dc motor (⅛ hp) is running too slow. It is decided to put a fixed value resistance in the field circuit to raise its speed about 20%. The plant owner is asked if their maintenance man has an ohmmeter, and, if so, to check the number of ohms in the shunt field. The ohms are found to be 960 ohms. By Ohm's law this indicates a field current of about ¼ amp. This value seems too high, so a request is made to again check this value. A second time the answer is 960 ohms.

A serviceman from the repair shop is sent to check the fields. They are found to have 2600 ohms. Where was the mistake?

The ohmmeter used was a multimeter with one scale for ohms—0 to 1000. Above 500 ohms, only a guess could be made as to actual values. The needle showed slightly below the 1000-ohm mark so it was guessed at 960 ohms. Even 5000 ohms moved the needle near that point. *Moral: Use a meter with a range beyond the maximum needed or don't read it at all.*

12 A new motor driving a new compressor for an air conditioning system overheats and occasionally trips out the thermal over-



current devices. An electrician for the owner checks and finds this motor drawing current (amps) in

(*Continued on page* 266)



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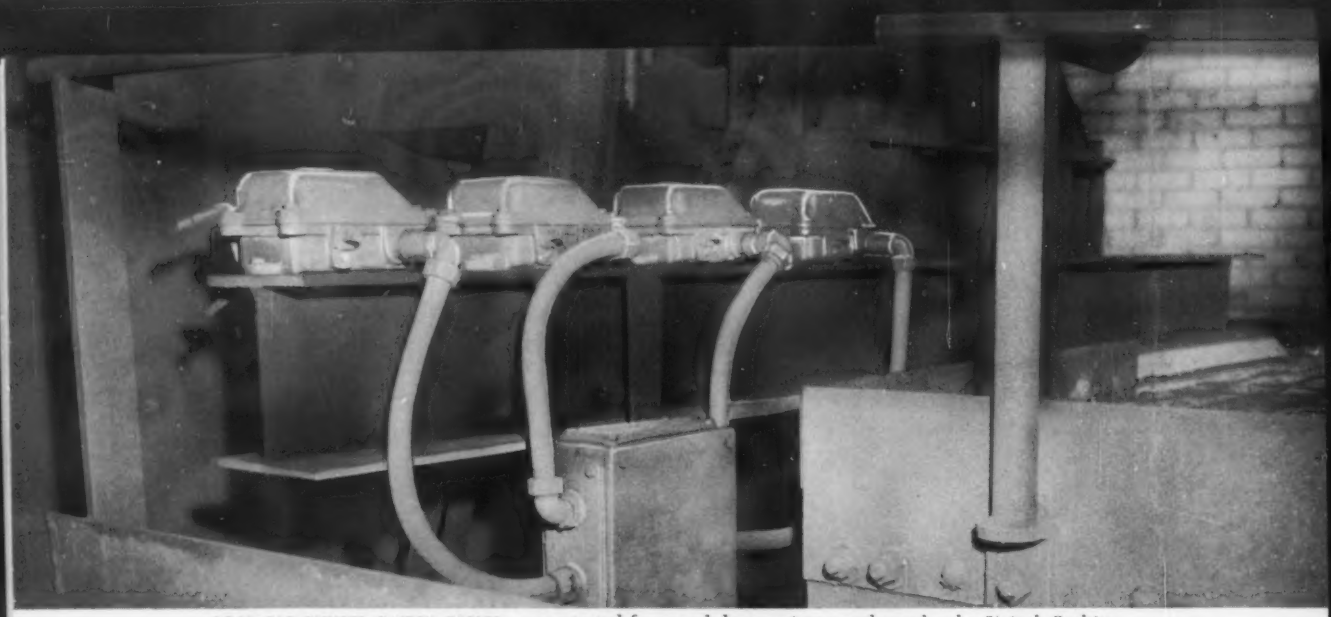
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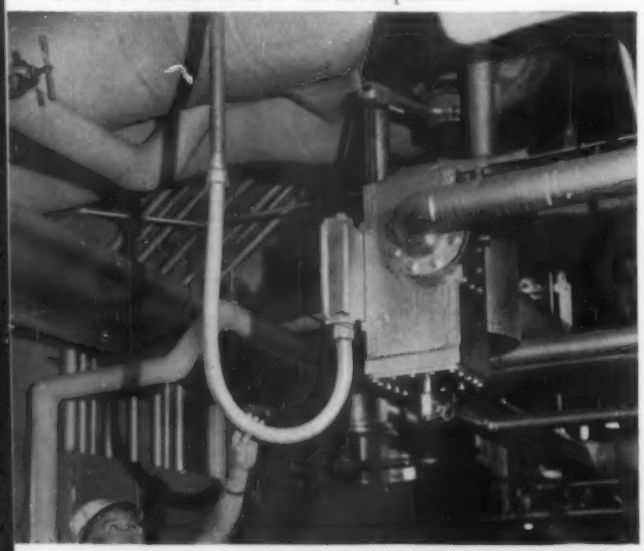
Coal dust, dirt, moisture, weather – it's pretty hard to keep them out of a power station – even harder to keep them from causing wiring trouble. But Duke Power has done it by sealing 6,000 feet of crucial wiring in Sealtite at the new Charlotte, N. C., Power Station.

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Look over the examples to see how Duke Power takes full advantage of Sealtite. Perhaps one of them might suggest a way you, too, can increase your wiring efficiency by eliminating potential trouble spots.

WHERE TO GET SEALTITE—Electrical Wholesalers stock Types U.A. and E.F. Sealtite in easy-to-handle coils,

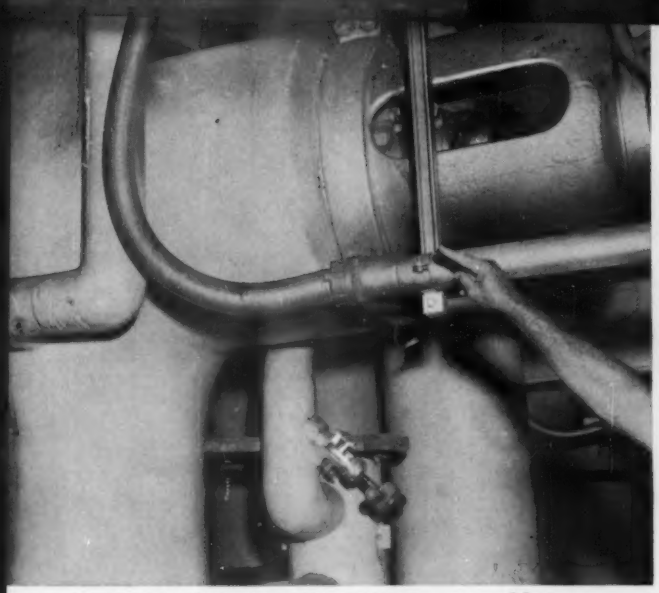
RE-HEAT VALVE CONTROL BOX CONNECTIONS are protected in 1½-inch Sealtite to accommodate re-heat line expansions.



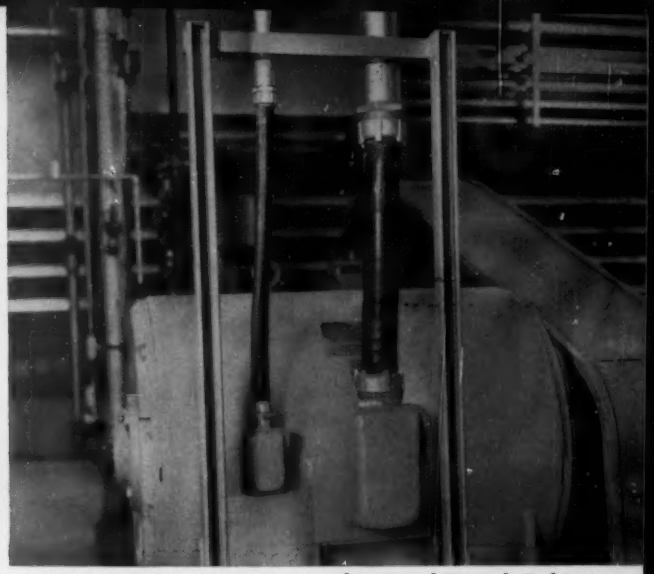
RADIAL DRILL CONNECTIONS are protected in 1-inch Sealtite for maximum flexibility, easier motor repair and replacement.



ONE-STOP SHOPPING



BOILER CIRCULATING PUMP CONNECTIONS are protected from movement due to expansion by 2½-inch Sealtite. Rigid conduit would crack.



COMPRESSOR CONNECTIONS are protected in 1- and 2½-inch Sealtite. Flexibility is a must because the motor is moved for belt adjusting.

WITH SEALTITE FLEXIBLE, LIQUID-TIGHT CONDUIT

in black or gray. Be certain you ask for and get the quality conduit marked "Sealtite" and "Anaconda" on the cover. Buy it in long lengths on reels or in cartons and cut it on the job without waste. Your wholesaler also stocks liquid-tight connectors. Free Booklet S-542 gives full information on Sealtite. Write: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. Sealtite is approved by Canadian Standards Association.



CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl chloride jacket over flexible metal core. Copper conductor wound spirally inside conduit gives positive ground.

Insist on the conduit marked

SEALTITE®

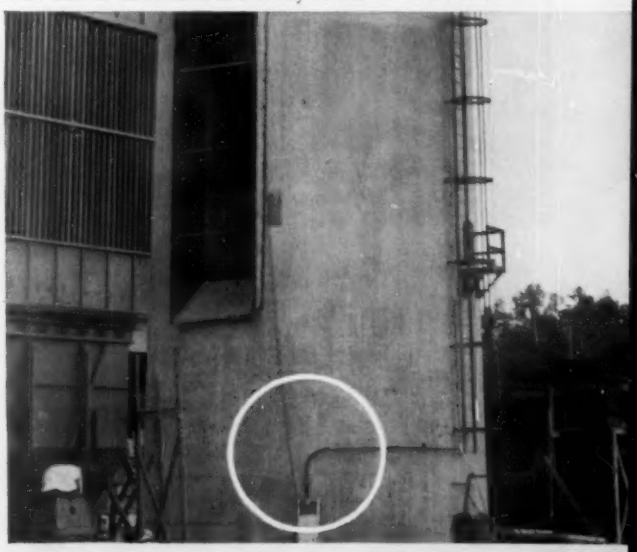
Flexible, Liquid-Tight Conduit

AN ANACONDA® PRODUCT

TRANSFORMER is connected to terminal boxes by 4-inch Sealtite because it can be easily disconnected, simplifying repairs.



SMOKE STACK LIGHTING WIRING protected by ½-inch Sealtite which offers ease of installation and ability to withstand weather.



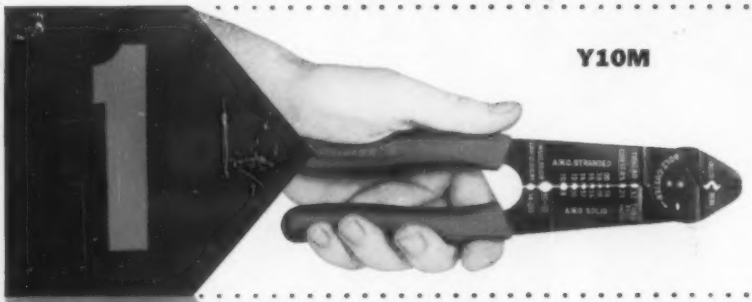
- **More Than 14,000 Products**
- **135 Local Branches**

come in or call **WESCO**

GET THE BIG 3

IN COMPRESSION-CONNECTOR TOOLING

1



Y10M

Light-weight hand tool installs a wide variety of HYDENT® connectors on wire sizes #22 thru #10. A wire cutter and single indentor die for all wire sizes are in the nose of the tool. Other features are wire stripper, bolt cutter, thread chasers, and dies for closing insulation-grips.

$3.95ea

2

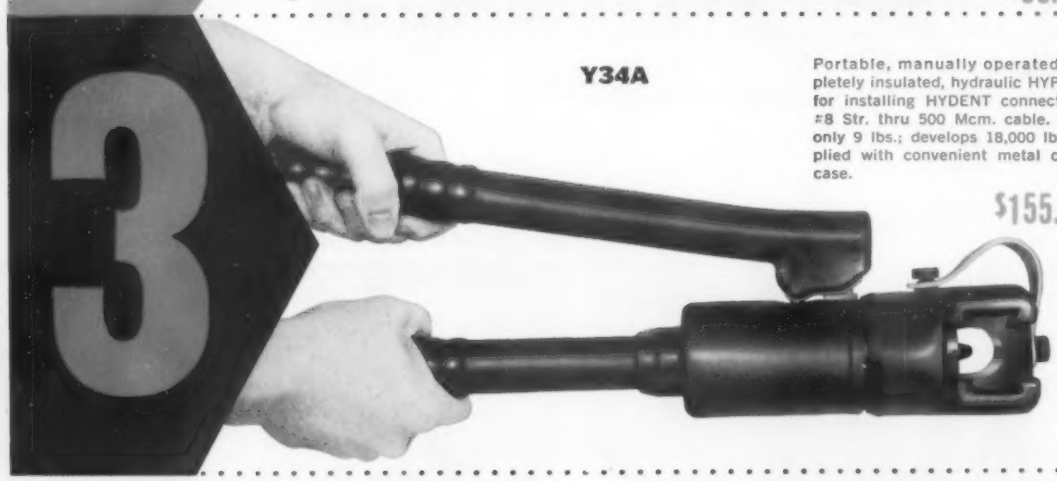


MY29-3

This HYTOOL® features one easily adjusted die set that installs HYDENT on commercial copper cable from #8 to 250 Mcm. and on aluminum conductors #8 to 4/0. Indexing plates are used for setting adjustable nest die for either copper or aluminum. No dies to install, change, identify or lose.

$36.00ea

3



Y34A

Portable, manually operated, completely insulated, hydraulic HYPRESS® for installing HYDENT connectors on #8 Str. thru 500 Mcm. cable. Weighs only 9 lbs.; develops 18,000 lbs. Supplied with convenient metal carrying case.

$155.00ea

Contractors with an eye on cutting connector installation time count on the Burndy Big 3. This Y10M, MY29-3, Y34A combination crimps practically every type and size compression connector on any job...adds the versatility, speed, and economy that result in profitable jobs. See your local Burndy distributor for demonstration.

BURNDY

59-15

Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

ONE-STOP SHOPPING



During processing, Anaconda Butyl passes through screens similar to this one—screens fine enough to hold water—fine enough to trap any undispersed particle which might cause future insulation trouble in high-voltage cable.

HOW AN ANACONDA PROCESS HELPS SCREEN OUT SERVICE FAILURE IN HIGH-VOLTAGE CABLE

Even butyl—the most effective rubber insulating material ever developed for high-voltage cable—requires additives to bring out all its superb insulating properties. These additives are usually in the form of finely divided powders which are extremely difficult to disperse uniformly in the raw butyl.

And actual service proves poor dispersion can drastically shorten high-voltage cable life.

That's why Anaconda developed an entirely new mixing process. And why Anaconda built screens (like the one you see above) into the production line to catch every oversized undispersed particle. These screens are so fine, they will actually hold water.

Yet tons of butyl insulating compound are squeezed through before the screens need cleaning—a tribute to the new mixing process. And—to the rigorous quality control which dominates every specialized step in the manufacture of Anaconda Butyl (AB) Cable.

This highly specialized quality control is probably the biggest single reason why Anaconda Butyl (AB) Cable gives such long trouble-free life. Why you should consider it the next time you buy high-voltage cable. Send for Publication DM 5903: High-Voltage Durasheath* Cable to Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. 59258WE

ASK THE MAN FROM

ANACONDA®

ABOUT BUTYL (AB) HIGH-VOLTAGE CABLE

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THOMAS JEFFERSON BUILDING

Electrical services are fed from two 4,000 amp. main distribution boards. Each of the main switch boards is fed by 8-500 MCM conductors per phase.

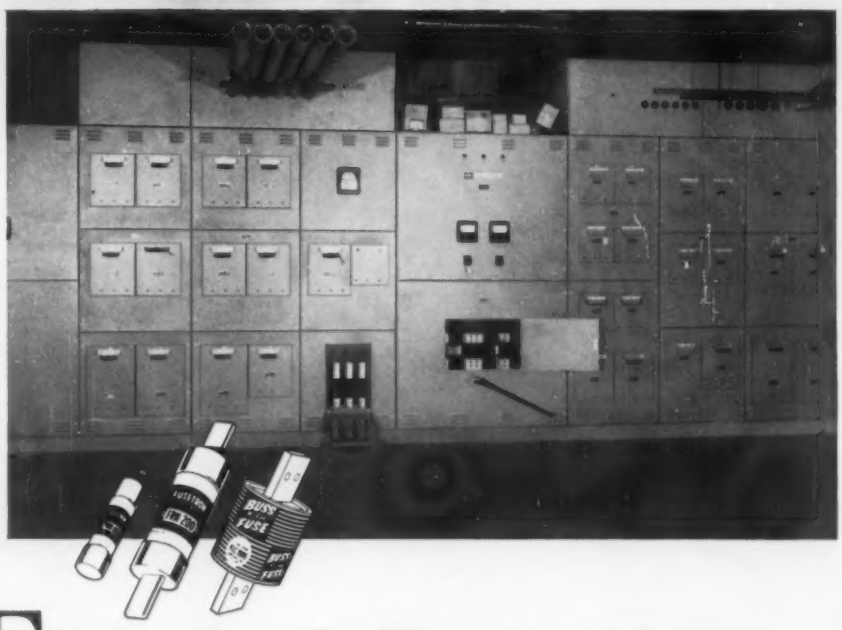
Switch Board #1

Protected by: 3-4000 amp. BUSS Hi-Cap Fuses . . . 12-600 amp., 30-400 amp., 3-200 amp. FUSETRON Fuses.

Switch Board #2

Protected by: 3-4000 amp. BUSS Hi-Cap Fuses . . . 6-600 amp., 33-400 amp., 39-200 amp. FUSETRON Fuses.

All distribution panels protected by FUSETRON dual-element fuses.



Electrical Protection goes MODERN *with* BUSS Fuses

in St. Louis' Newest Multi-Storied Office Building . . .

The Thomas Jefferson Building is another outstanding example of BUSS Hi-Cap and FUSETRON dual-element fuses meeting the requirements for a modern protective device for use in modern electrical systems.

Today's electrical networks, with their tremendous capacities, have emphasized the need for a superior protective device that can be relied on to safely and dependably handle faults of great magnitude.

BUSS Hi-Cap and FUSETRON fuses, because of their high interrupting capacity and life-time dependability have become the natural choice in both new installations and when electrical systems are being modernized.

WHY HIGH-INTERRUPTING CAPACITY AND DEPENDABILITY ARE ESSENTIAL FOR A MODERN PROTECTIVE DEVICE...

CAPACITY

The magnitude of fault current is only limited by the capacity of the transformers or networks. These capacities have been increasing yearly — and most likely will continue to increase.

A modern protective device, therefore, must be capable of interrupting faults of 75,000 to 150,000 ampere which are available today — and be adequately safe to allow for future system growth.

BUSS Hi-Cap and FUSETRON dual-element fuses meet this requirement. The interrupting rating of BUSS Hi-Cap fuses is 200,000 rms symmetrical — and for FUSETRON fuses it is 100,000 rms symmetrical.

LIFE-TIME DEPENDABILITY

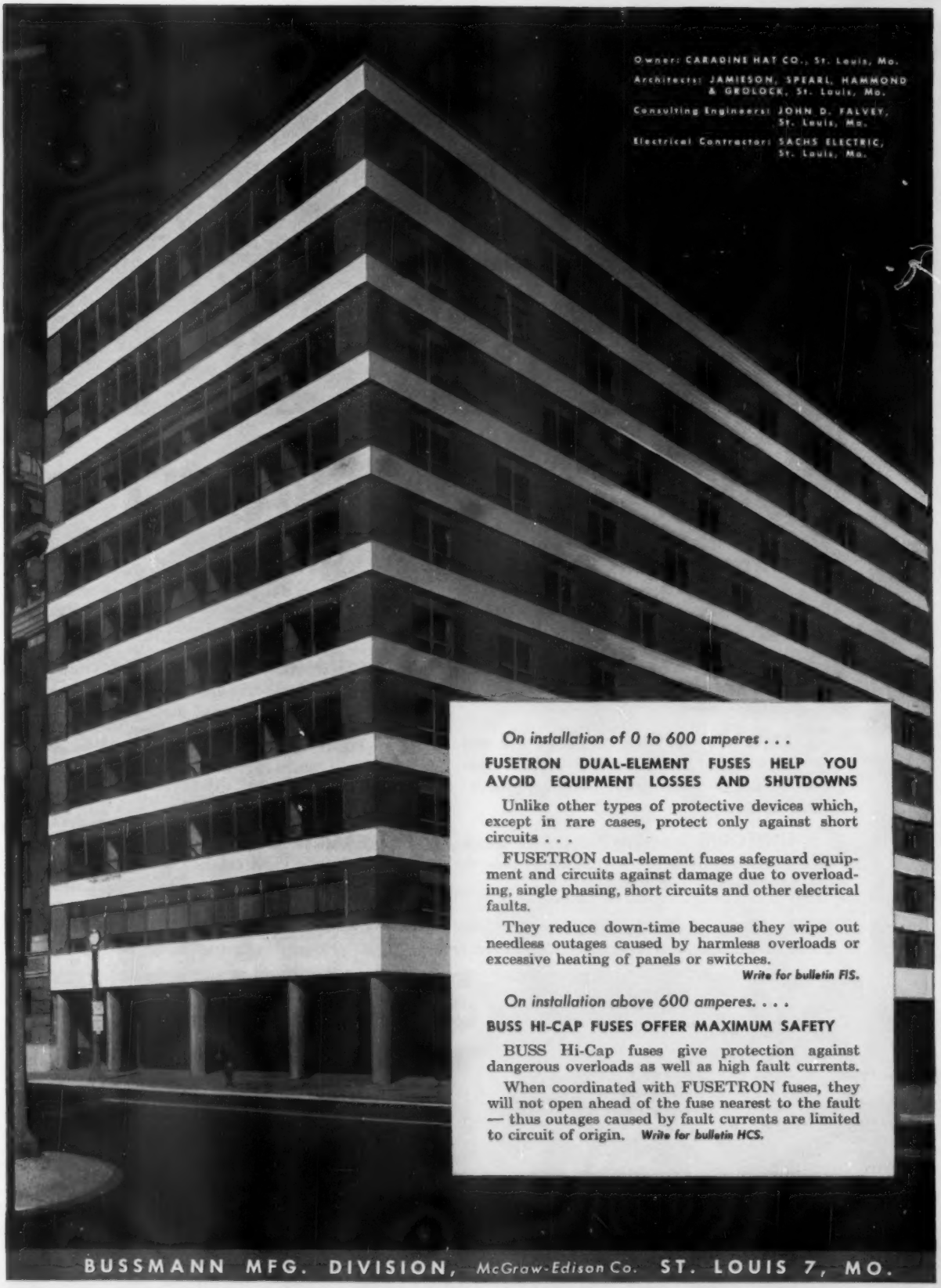
The *Modern* protective device should remain just as safe and accurate through the years as it is on the day installed. Otherwise, how can you be sure it will interrupt these high fault currents should trouble occur 10, 15 or 20 years from now.

This requirement too, is met by BUSS Hi-Cap and FUSETRON fuses — They remain safe and accurate and require no periodic inspection or recalibration, as they have no hinges, pivots, latches or contacts to stick or get out of order.

1159

ANOTHER BUSS HI-CAP AND FUSETRON FUSE INSTALLATION

ONE-STOP SHOPPING



On installation of 0 to 600 amperes . . .

FUSETRON DUAL-ELEMENT FUSES HELP YOU AVOID EQUIPMENT LOSSES AND SHUTDOWNS

Unlike other types of protective devices which, except in rare cases, protect only against short circuits . . .

FUSETRON dual-element fuses safeguard equipment and circuits against damage due to overloading, single phasing, short circuits and other electrical faults.

They reduce down-time because they wipe out needless outages caused by harmless overloads or excessive heating of panels or switches.

Write for bulletin FIS.

On installation above 600 amperes. . . .

BUSS HI-CAP FUSES OFFER MAXIMUM SAFETY

BUSS Hi-Cap fuses give protection against dangerous overloads as well as high fault currents.

When coordinated with FUSETRON fuses, they will not open ahead of the fuse nearest to the fault — thus outages caused by fault currents are limited to circuit of origin. ***Write for bulletin HCS.***

BUSSMANN MFG. DIVISION, *McGraw-Edison Co.* **ST. LOUIS 7, MO.**

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• 135 Local Branches

come in or call **WESCO**

8 reasons why



BERMICO® FIBRE CONDUIT

is your best cable protection

1. **WATERPROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high—even under toughest conditions.

2. **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.

3. **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!

4. **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.

5. **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.

6. **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport ...the heavy loads imposed during installation.

7. **TIGHT.** All joints are precision milled for light, speedy installations.

8. **EASILY HANDLED.** So light in weight that one man can carry several 8-foot lengths at once—lay more per working hours.

BERMICO
ELECTRICAL CONDUIT

Bends, Elbows, S-Bends and Curved Segments, plus a *complete line of fittings:* Adaptors, Plugs, Caps, Reducers, End Bells, Expansion Joints. Write for Bermico Conduit Catalog 12002.

Distributed by

WESTINGHOUSE ELECTRIC SUPPLY COMPANY

Offices in principal cities

For best cable protection be sure to specify

BERMICO FIBRE CONDUIT
A Product of
BROWN COMPANY
Mills: Berlin, N. H.; Corvallis, Ore.

For competitive prices—Call WESCO—for Quality Electrical Supplies and Service

ONE-STOP SHOPPING

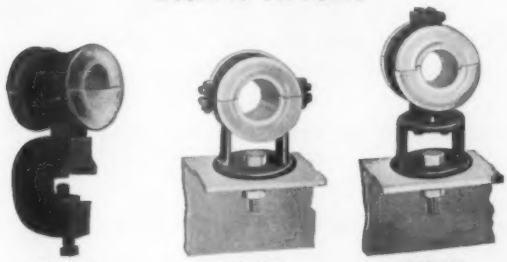
Efficiency

SUSPENSION DEVICES

ARE TIME AND COST SAVERS

By eliminating the need for punching, drilling or burning through beams in order to hang electrical mountings . . . Efficiency Suspension Devices can save you time and expense on practically every construction job.

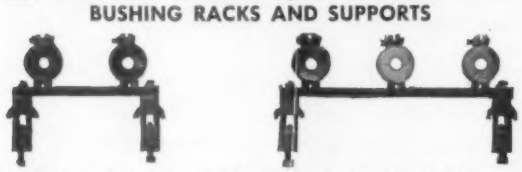
BUSHING SUPPORTS



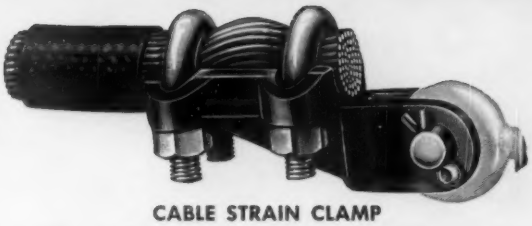
TYPE G TYPE VG TYPE VB

Designed to eliminate the drilling of holes for mounting, these supports are adjustable to any angle. Made of malleable iron with highest quality split porcelain, they are furnished for AC-DC service to handle 5/16" to 2⅜" cable. Type G is clamp-mounted while Type VB and VG bolt mounted through its circular base.

BUSHING RACKS AND SUPPORTS



Available in 2, 3, 4, 5 and 6 bushing racks for AC or DC service. Only a single bolt is required to support the bushing and clamp the support to the rack. For 5/16" to 2⅜" wire sizes.



CABLE STRAIN CLAMP

Capable of withstanding a direct pull of over 12,500 lbs. before slipping, this clamp can be furnished either with eye or clevis. These clamp sizes accommodate all cable sizes from 1/0 to 1,500,000 c.m. Constructed of malleable iron, this clamp has a high ridge across the center of the cable channel and a U-bolt at each end.

BUSHING MESSENGER SUPPORT

This support is designed to suspend wire or cable from messengers where beam mounting is not possible. This support is a combination of our Type G Bushing Support with strip steel messenger attachment. Furnished complete with malleable iron support, steel messenger attachment and all bolts, as illustrated.



NESTED BUSHING RACKS AND SUPPORTS



Simply and compactly designed to carry conductors equidistant from center to center. Each bushing is a separate unit, allowing independent installation of each cable line. Available in 2, 3, 4, 5 and 6 bushing racks.

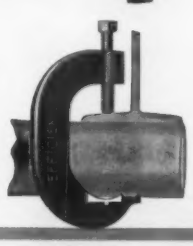


NON-ADJUSTABLE INSULATOR SUPPORT



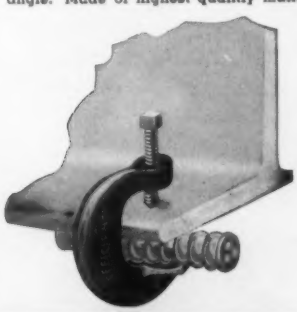
ADJUSTABLE INSULATOR SUPPORT





CONDUIT HANGERS

Correctly designed for carrying armored cable or ½" to 2¼" pipe along open steel construction. Radiating ridges and the five point gripping surface keeps the pipe suspended dead center, with the set screw above permitting the cable or pipe to be carried at any angle. Made of highest quality malleable iron.





EFFICIENCY ELECTRIC AND MANUFACTURING COMPANY

Write for Catalog EAST PALESTINE, OHIO

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CRESCENT

ABC ARMORED CABLE, TYPE ACT

With Improved Features

EASIER • QUICKER • SAFER



★ PLASTIC INSULATED CONDUCTORS are clean, easy stripping, with solid, clear colors, and minimum diameter for easier installation in boxes.

★ PAPER TAPE which is tough, moisture-resistant yet easily removed, gives protection to the insulated conductors.

★ INSULATED BUSHING for protection against sharp ends of armor, furnished with each coil of cable.

★ BOND STRIP UNDER ARMOR is used in all sizes. A flattened aluminum bonding wire in contact with the under side of each convolution of the galvanized steel armor assures a permanent, low resistance through armor to ground.

★ PREFABRICATED BREAKING LINES. At intervals of every 1½ inches on CRESCENT ABC Armored Cable you will find a small cut mark. This cut mark shows the location of a prefabricated breaking line inside the armor.

Only a few short strokes of a hacksaw guided by the cut mark are required to cut through ONE outer ridge, and a bend by hand severs the armor. By actual test, this saves 30% of the time ordinarily required. A clean separation results, with no sharp edge. There is no chance of injury to insulation because only one OUTER ridge is cut.

The prefabricated breaking lines in the armor are so made that THERE IS NO REDUCTION of tensile strength, bending qualities, crushing resistance or electrical conductivity. This armor construction meets all requirements of Underwriters' Laboratories.

CRESCENT WIRE & CABLE

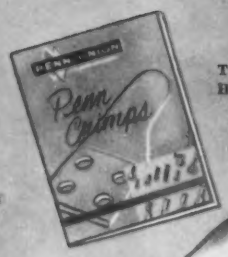
OVER 75 YEARS EXPERIENCE

CRESCENT INSULATED WIRE & CABLE CO.

Trenton, New Jersey

ONE-STOP SHOPPING

For your convenience— the *complete* line of crimp connectors, No. 22 to 2,000,000 CM. Copper and aluminum lugs, splices, etc., and tools.



TYPE HVJR

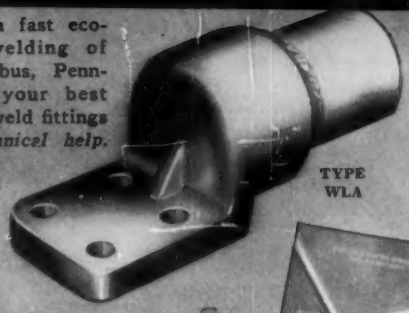
TYPE BLU

Crimp

Pioneers in fast economical welding of aluminum bus, Penn-Union is your best source of weld fittings —and *technical help.*



TYPE WTFA



TYPE WLA

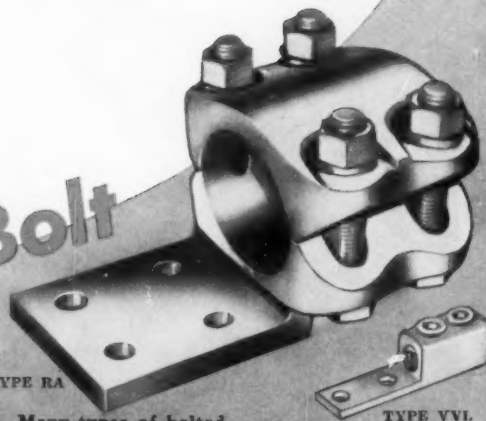
Weld



You name it

We have it

Bolt



TYPE RA

TYPE VVL

Many types of bolted lugs, splices, bus fittings, No. 12 to 2,500,000 CM. Copper and aluminum.



TYPE LD



Solder

TYPE SL



TYPE SL

Once the standard connection, still widely used. Single and two-hole lugs, No. 10 to 2,000,000 CM.

PENN-UNION

a good connection

PENN-UNION ELECTRIC CORP., Erie, Pa.

Export Sales—Philips Export Co., 100 East 42nd St. New York 17, N. Y.

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This is a distributor.

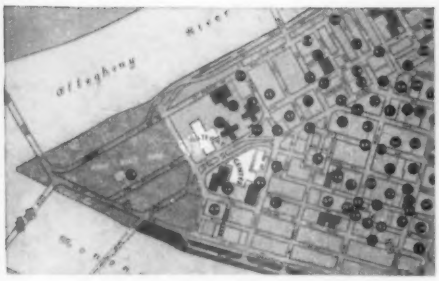
"The hard-hat jobs...the really big ones... go to the company that earns a reputation for technical service."

That's Bill Shores talking. And he knows what he's talking about. As salesman for Westinghouse Electric Supply Co. (WESCO) in Pittsburgh, he heads up the contact, estimating and technical service team that works with accounts in the building construction industry.



Shores rates technical service among the top functions a distributor can perform for the builders and electrical contractors who handle those big jobs that mean *volume*. And as he points out, "Anybody can do an estimate for the routine parts of an installation, no matter how big. What pays off is the ability to be of real help in the more unusual or more sophisticated systems that are part of most big jobs. If you can come through here, with the engineering suggestions, precision estimating, and on-the-job technical follow-up—then the more routine parts of the job come to you also."

ONE-STOP SHOPPING



One man who is virtually a member of WESCO's heavy construction team is Robert J. Doherty, Pittsburgh District Manager for Edwards. At right, in hard hat, Doherty goes over blueprints of fire alarm system for Four Gateway Center with Electrical Engineer Norman Murray (left) and foreman C. J. Siefert, both of Frame Electric Company, electrical contractors for the building.



Technical service continues through all phases of basic construction. For example, components must be on hand when required by the construction schedule, since no substitutes are possible at this stage. Smooth follow-up is therefore another vital aspect of Shores' technical service program at WESCO. At Gateway Center Underground Garage, R. A. Krall, assistant superintendent for contractors Hale Electric Company, comments on this follow-up: "WESCO and Edwards have checked regularly with us, realizing the critical importance of deliveries timed so the job proceeds without hitches or delays." Here, Rudy Krall and foreman Erny Barthel discuss panel of fire alarm signal control center with Doherty of Edwards.

One result of emphasizing technical service: Westinghouse Electric Supply Company and salesman William B. Shores have participated heavily in the recent dramatic rebuilding of Pittsburgh's famed Golden Triangle. They are now suppliers to the contractors for three new Golden Triangle projects: the Pittsburgh Hilton Hotel, Four Gateway Center and Gateway Center Underground Garage. All three of these new projects have fire alarm systems by Edwards. With a different contractor and different fire alarm requirements for each project, the importance of technical service to WESCO's success is clearly demonstrated.



For the Edwards fire alarm installation in the new Pittsburgh Hilton Hotel, special problems in the mounting of back boxes in certain areas were encountered due to conduit layout. Bill Shores of WESCO, working with electrical engineer Len Matonak (left) and field engineer Art Fallon of Patterson, Emerson, Comstock, Inc., contractors, outlined the changes required to the standard boxes normally supplied. Bob Doherty of Edwards was in regular consultation with Shores and the contractors during this period to effect needed revisions of the Hilton's ultra-modern fire protection system.



MODERN COMMERCIAL and INDUSTRIAL DEVELOPMENT CALLS FOR EDWARDS FIRE ALARM SYSTEMS

These three latest Edwards fire alarm installations in Pittsburgh's Golden Triangle illustrate how—from alarm station through central control to warning signal—variations in Edwards systems can be engineered to fit every requirement. Alarm stations may be manual pull-boxes of Edwards' exclusive modern design, and/or automatic detectors. Other features that can be incorporated:



Control Panel



Automatic Thermal Detectors



Alarm Bell



Manual Station

coded signals — indicating where the alarm originates

city connection — to alert municipal fire headquarters automatically

pre-signals — so authorized personnel can determine location and extent of fire condition before sounding general alarm

variety of signals — Edwards horns, bells, or chimes depending upon type of signal required

Edwards field engineers and fire alarm technical specialists stand ready to assist you to utilize the unique flexibility of Edwards systems and components in every application.

The Edwards Company believes that distributors have an important but sometimes under-rated job to do in the electrical industry. Often we run across a man in distributing, like Bill Shores of WESCO, who is doing his job very well indeed. We're glad to be able to relay his ideas.

EDWARDS

Specialists in signaling since 1872
CONTROL • COMMUNICATION • PROTECTION
Edwards Company, Inc., Norwalk, Connecticut
(In Canada: Edwards of Canada, Ltd, Owen Sound, Ontario)

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• 135 Local Branches
come in or call WESCO

CROUSE/HINDS

Condulet®

electrical equipment

the one complete line for corrosive locations



Photo shows Feraloy Condulet conduit fitting after several years exposure to hydrochloric acid. Note extreme deterioration of conduit.

RESISTS chemical and galvanic corrosion

RESISTS acids, alkalis, salts

RESISTS varying concentrations and temperatures of corrosive liquids, vapors, gases, dusts

Corrosion problems would be simple if there were a single material which would resist all corrosive substances.

Since there is not, Crouse-Hinds provides electrical equipment in four materials which offer a selection to meet virtually every known corrosion problem . . .

FERALOY® features the desirable characteristics of cast iron: strength, corrosion resistance, versatility, adaptability, economy. Plated with zinc and cadmium, Feraloy Condulets will combat most corrosive elements.

ALUMINUM ALLOY develops its own self-repairing oxide film which resists a number of corrosive conditions. Copper-free Aluminum Alloy Condulets effectively resist galvanic corrosion.

PLAST-A-COAT, a polyvinyl chloride, is a resilient coating which withstands abrasion and repels corrosion from caustics, alkalis and heavy mineral acids. Tough, non-peeling, it also acts as an insulator.

SILICON BRONZE, when all other materials fail, can be furnished for the most extreme corrosion problems. Counteracts virtually all alkalis as well as salt water, sulfur gases, etc.

CROUSE/HINDS
SYRACUSE NEW YORK

Write for **BULLETIN #2699** containing full information on Crouse/Hinds Condulets for Corrosive Locations.



Offices: Atlanta, Baton Rouge, Birmingham, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Corpus Christi, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Oregon, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Tulsa, Washington. Resident Representatives: Albany, Baltimore, Reading, Pa., Richmond, Va.
Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.
Crouse-Hinds Instrument Company, Inc., Silver Spring, Md.

ONE-STOP SHOPPING



RAPID REFERENCE CHART

SERIES	OPERATION	SWITCH	VOLTAGE	AMPS.	INTERMATIC QUALITY FEATURE
T 100	1 to 12 on-off per day	SPST DPST SPDT	125/250 volts	35	Standard ON-OFF switch.
T 170	1 to 12 on-off per day	SPST DPST SPDT	125/250 volts	35	Same as above, plus skips operation on selected days, automatically.
T 180	1 to 12 on-off per day	SPST SPDT	125/250 volts	35	Each on-off period independently adjustable from 5 to 60 minutes.
T 960	1 to 96 on-off per day	SPST SPDT	125/250 volts	20/15	Each on-off period in 15 minute units. Trippers permanently attached to dial.
C 8300	1 to 12 on-off per 12 minutes	SPST	125 volts	15	Timings from 10 seconds to 11 minute, 50 second periods.
T 500-R	1 to 12 on-off per day	SPST DPST	125/250 volts	55	Heavy duty standard ON-OFF switch. Up to 27,500 watts. Also available with "SKIPPER" feature.
T-1100	1 on -off operation per day	SPST	125 volts	15	Flush wall mounted standard ON-OFF switch to central circuits in house or store. (LAMP • LYTER)



WRITE FOR FREE CATALOG OF COMPLETE INTERMATIC LINE Bulletin 119-B

NEW! Intermatic. Hi-Fidelity DOOR CHIMES

the NEW sound!

for new or remodeling construction . . . styled for any home decor. Modern . . . all models with multiple tones! Flush or surface-mount models. Many finishes.



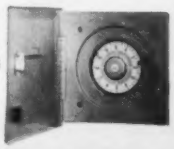
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NEW! LAMP • LYTER

the light switch with an electric brain!



FOR HOME AND STORES flush mounts, controls post lights, store lights, signs, other selected circuits.

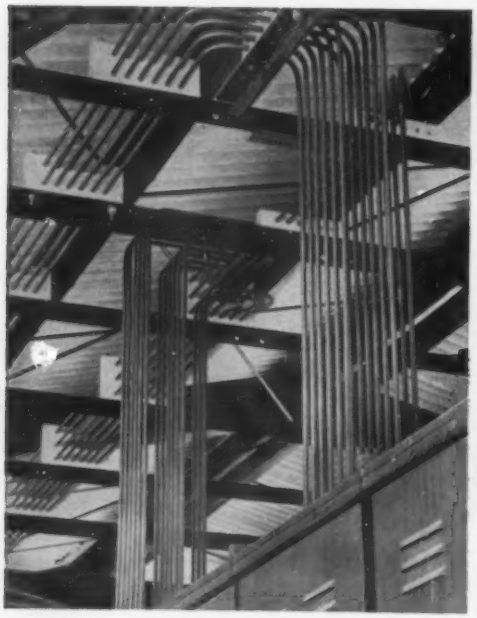


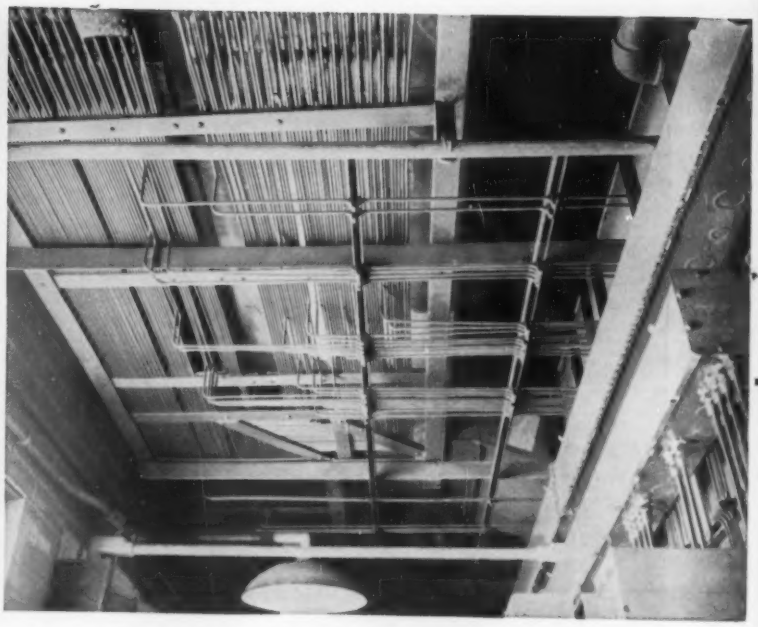
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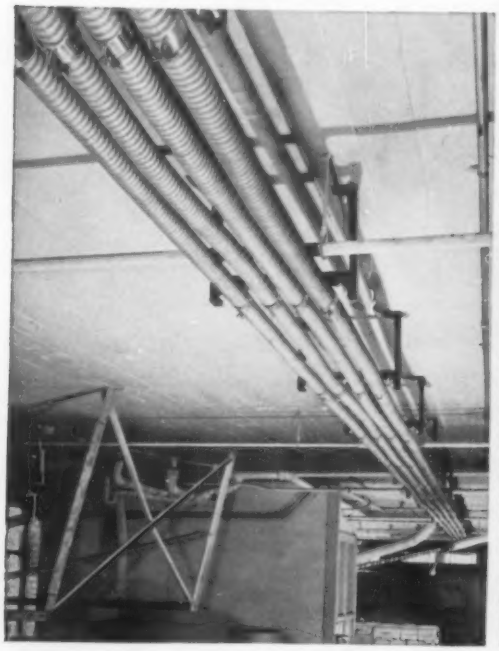
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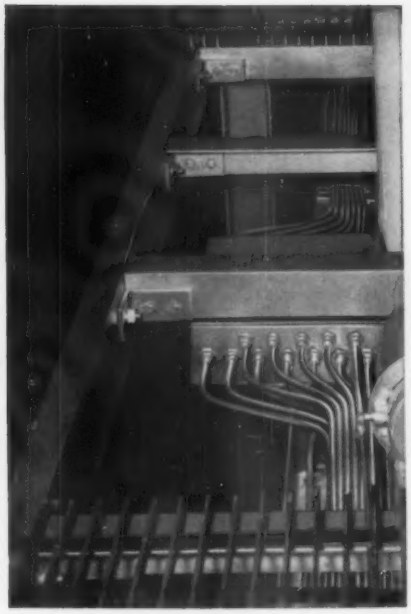
the right combination for





ONLY GENERAL CABLE MANUFACTURES BOTH TYPE MI AND INTERLOCKING ARMORED CABLES.

ONE-STOP SHOPPING



type mi cable

for power distribution, control and lighting circuits

TYPE MI CABLE has solid copper conductors and sheath separated by highly compressed inorganic insulation! Just about indestructible, yet it trains easily over and around obstructions. Naturally it needs no protection: just train it and terminate it. MI is compatible with all other wiring systems. It is completely resistant to moisture, age, nearly all chemicals, temperatures up to 185°F with standard terminations, 482°F with special terminations; and it is approved for use in hazardous areas. It will last forever.

industrial power

Type MI Cable and Interlocking Armored Cable work together to lower installation costs, minimize space requirements, provide maximum flexibility and accessibility in your cable systems.



inter-locking armored cable

for feeder circuits

GENERAL CABLE'S Interlocking Armored Cable combines flexibility with the mechanical protection normally afforded by metallic conduit, yet has the same current rating as cable in free air. It can be trained to fit the contours of buildings and surrounding equipment and provides a neat, compact installation. It is available in bronze, aluminum and steel and may be applied over most cable insulations in the voltage ranges recommended by industry standards. Protective coverings are available to combat environmental conditions which might cause pitting or corrosion of the interlocking armor.



GENERAL CABLE CORPORATION

730 Third Ave.
New York 17, N. Y.

GENERAL CABLE

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• 135 Local Branches

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IDEAL WIRING TOOLS...

a good way to cut costs thru faster better work by the Man-on-the Job!

Ideal Wiring Tools help your men do a better job faster. Contractors and electricians coast to coast consider Ideal tools "standard" equipment for ease of use and efficiency on the job.

Get exactly the tools you need—when you need them. It's fast and economical, just specify Ideal—one dependable source for everything in electricians tools. Shown here are just a few items from the complete Ideal line.

IDEAL VOLTAGE TESTER

"Easy Tester" 2-ways safe



This is a voltage tester that protects you two ways! It has both a neon test lamp and a calibrated solenoid indicator . . . each independent of the other. No chance of failure to detect voltage. Handy center mount for the prod keeps the indicator always in the line of vision. Case is of double strength seamless plastic, with no external metal. Molded prod handles have "No-Slip" safety rings, are mounted on 30" leads. Prods when not in use are completely shielded in case. Tests 110 to 550 volts AC—110 to 600 volts DC.

IDEAL FISH TAPE REEL and PULLER

The big grip that takes most of the work out of fishing. Actually lets you do the job in 50% of the time as compared to hand fishing . . . like an extra arm or bigger muscles. And they may save your life—because the tape is always in reel or conduit. It can't ever spring loose into "hot" wires or moving machinery. Also, no cuts, skinned fingers or lost time! 50 to 200-foot lengths — all tapes of finest oil tempered flat spring steel.





IDEAL FISH TAPE WINDER

"Fishing" made easy

Just roll it around our IDEAL Fish Tape Reel. Spreads the Reel housing, so that Tape reels in or out much more easily. Just rotate the handle. Double rollers hold the Winder in place. Three sizes fit all IDEAL Reels.



IDEAL WIRE LUBE

Less Work, Strain, and Danger of Insulation Breaks!

IDEAL Wire-Lube actually lubricates wires and cables just like the oil you use in your car to lubricate bearings. It lets you slide wires into or out of conduit easier, dries to a fine powder, is as gentle on your hands as a fine soap. It is non-combustible, non-corrosive. For use on rubber, lead or plastic covered wire or cable. Available in 1 quart cans to 5-gal. pails.



NEW Low Cost WIRE STRIPPER

Strips wires from 10-18 ga. cleanly, quickly, and easily. Also used for cutting and "looping" wires. A handy addition to every electrician's tool kit. Sturdy, compact-constructed of hardened steel for rugged duty and long service life. Contoured plastic grips for easy handling and safety. Overall size 6". Flat design for easy tool kit and pocket fit.

IDEAL "E-Z" STRIPPER

6 models including *UF cable stripper



Used more, liked more and sold more than any stripper we know of. Rugged, all-steel and as easy to use as pliers. They are so designed that they can't damage wire or crush stranded wire ends, because of their automatic lock. Replaceable blades are of hardened steel. Six models handle all wire gauges from No. 8 to No. 26, also 300 ohm TV down lead and most non-metallic sheathed cable. The stripper for heavy-duty work.

**"E-Z" UF cable stripper strips the outer sheath and web, then the inner conductors (2 or 3 wire, 12 or 14 ga.) from non-metallic sheathed cable—without cutting, nicking, or other damage to wire ends.*

IDEAL COMBINATION FUSE PULLER AND TEST-LITE



NEW

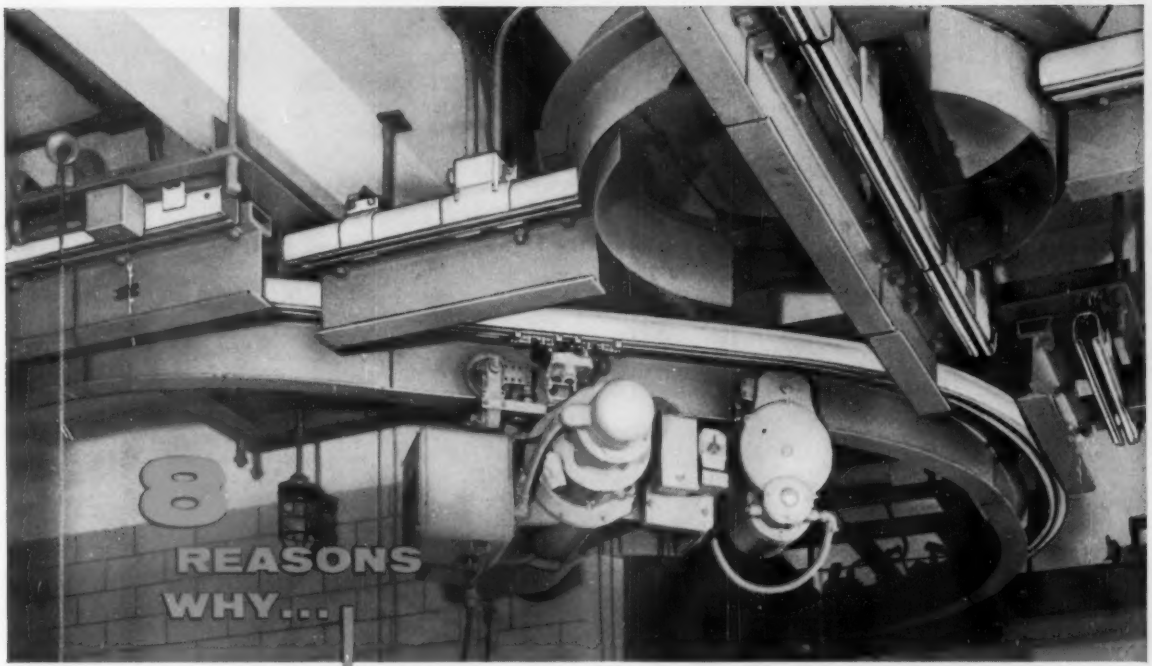
A new tool for maximum safety in pulling cartridge-type fuses and in checking electrical connections. Sure-grip dielectric plastic handles make fuse pulling faster. Positive testing is assured by built-in resistors which limit current flow through the tester. Test capacity from 100V. to 600V. AC or DC. Designed for use on fuses up to 100 amp., 250 volts and 60 amps., 600 volts.

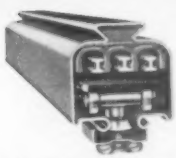
IDEAL INDUSTRIES, Inc.

1041-K Park Avenue, Sycamore, Illinois

ONE-STOP SHOPPING

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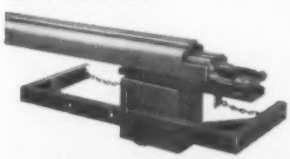




FEEDRAIL "60" – For budget hoists and low tonnage cranes with motor loads up to 5 hp. at 220 V., 3 Phase. Intermittent rating for Cranes and Hoists, 90 amperes; continuous current rating, 60 amperes; 250 volts A.C. or D.C.; 2 or 3 pole. Complete data in Bulletin No. 60.



FEEDRAIL "100" – For medium tonnage cranes and hoists with motor loads up to 60 hp. at 550 V., 3 Phase. Intermittent rating for cranes and hoists, 150 amperes; continuous current rating, 100 amperes; 575 volts A.C. or 250 volts D.C., 2 or 3 pole. Complete data in Bulletin No. 75.



FEEDRAIL "HEAVY DUTY" – For heavy duty cranes and hoists with motor loads up to 200 hp. at 550 V., 3 Phase. Continuous current rating, 225, 375 or 500 amperes; 575 volts A.C. or 250 volts D.C.; 2 or 3 pole. Complete data in Bulletin No. 70.

...discriminating buyers choose

FEEDRAIL

Crane & Hoist Electrification Systems

1. **Electrical Safety**—Heavy gauge steel housing encloses copper bus bars, track-supported trolleys with positive polarization and uniform contact pressure, and every other provision making an electrical system safe and fool-proof is incorporated.

2. **Personnel Safety**—Metal enclosure protects plant and maintenance personnel. No dangerous bar conductors and accident-causing broken wires, trailing or strung cables.

3. **Dependability** – Rugged, precise construction, pays dividends in power continuity and maintenance—keeps cranes and hoists rolling!

4. **Adaptability**—Prefabricated runs may be of any length, straight or curved, with turntables, slide or tongue switches. Readily adaptable to suit changed conditions, every part re-usable.

5. **Compactness**—Single metal housing occupies less than half the space of open conductors or sheathed bars. Looks neat, too!

6. **Easy Maintenance**—Replacement of parts is negligible. Any part can be replaced without interfering with the rest of the installation.

7. **Life-Time Use**—Never becomes obsolete! Assures power for the life of the crane or hoist. Outlasts other types of electrification.

8. **Low Installation Cost**—Nothing left to do on the job site but to connect units together—fast—because everything has been engineered to fit installation requirements. No special tools!

Information for you: Your local Wesco Representative can show you how easily the right Feedrail System can be installed for your cranes and hoists. See him or write Feedrail—Dept. C11.

ELECTRIC FEEDRAIL® *Never Becomes Obsolete*

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

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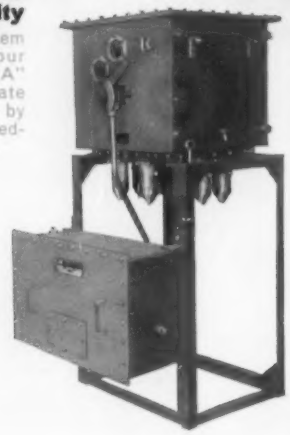
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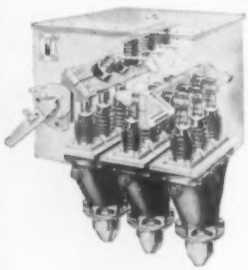
equipment of proved dependability

LOAD-BREAK OIL SWITCHES provide cable system flexibility

Reduce overtime work on system maintenance. Sectionalize your distribution system with Type "RA" load-break oil switches. Isolate cable faults and restore service by switching loop or duplicate feeders—manually or automatically.

Send for series "D" bulletins.





SPLICING KITS, pre-engineered to save time and money



Each item supplied in the correct quantity for a properly designed joint. Time and expense of securing various items from different sources are saved. Accumulation of dead stock is avoided; no waste. All materials kept clean and ready for use. Each splicing kit labeled for easy identification. Cable splicing costs can be determined accurately.

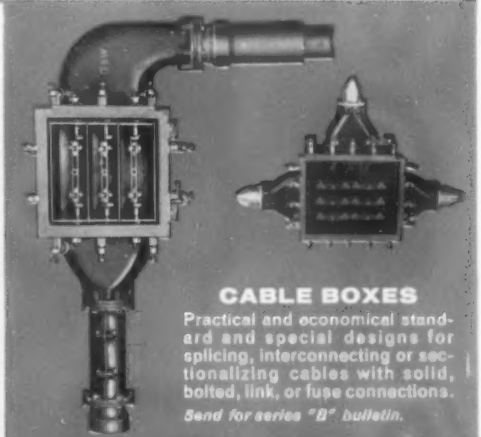
Send for series "J" bulletins.

OIL FUSE CUTOUTS



For fusing or load-break switching of primary circuits in subway, vault, or overhead installations. All steel enclosure, oil filled, hermetically sealed, protects men and equipment by safely withstanding high pressures of fuse clearing heavy short circuits.

Send for series "C" bulletin.



CABLE BOXES

Practical and economical standard and special designs for splicing, interconnecting or sectionalizing cables with solid, bolted, link, or fuse connections.

Send for series "B" bulletin.

POTHEADS for every high voltage cable



Sodertite, capnut, disconnecting. Solder, clamp, or press-style connectors for copper conductors; press-style for aluminum conductors. Wiping sleeve or stuffing box cable entrance seals. Conduit and armor fittings.

For detailed information on the complete G & W line send for series "A" bulletins.

G&W ELECTRIC SPECIALTY CO.

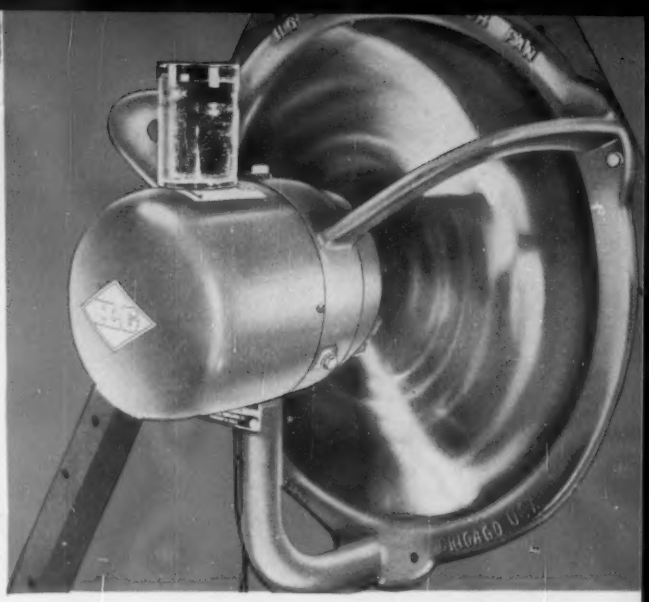
3514 W. 127th Street, Blue Island, Ill. Representatives in principal cities of N. and S. America

Canadian Mfgr.: Powerlite Devices, Ltd., Toronto

ONE-STOP SHOPPING

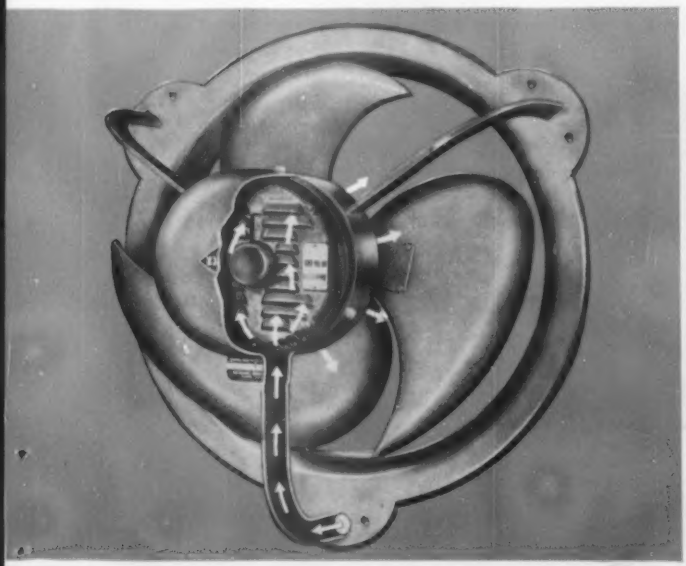


At His Finger Tips (and Yours). Ilg's "One-Name-Plate" guarantee covers both the Ilg-built *self-cooled*, direct-connected motor and the dynamically balanced, patented "Q" Type fan wheel.

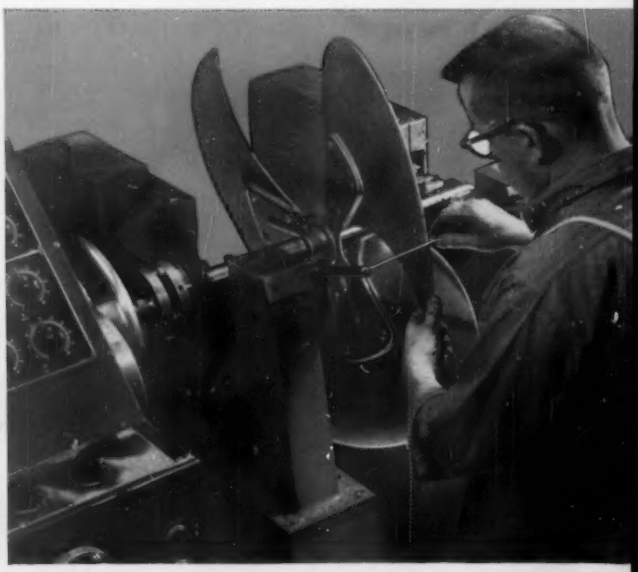


Not a Ripple at 1140 revolutions. Put a glass of water on an Ilg direct-connected, *self-cooled* propeller fan and you'll see how vibration-free a fan can be at full operating speed. Notice: not a ripple!

only at ILG can you count on all four



Follow the Arrows and you'll see why Ilg-built *self-cooled* motors stay cleaner, run quieter, last longer. Vent pipe brings in clean outside air; pressure cools direct-connected motor . . . exhausts air at front of fan. Motors never run hot.



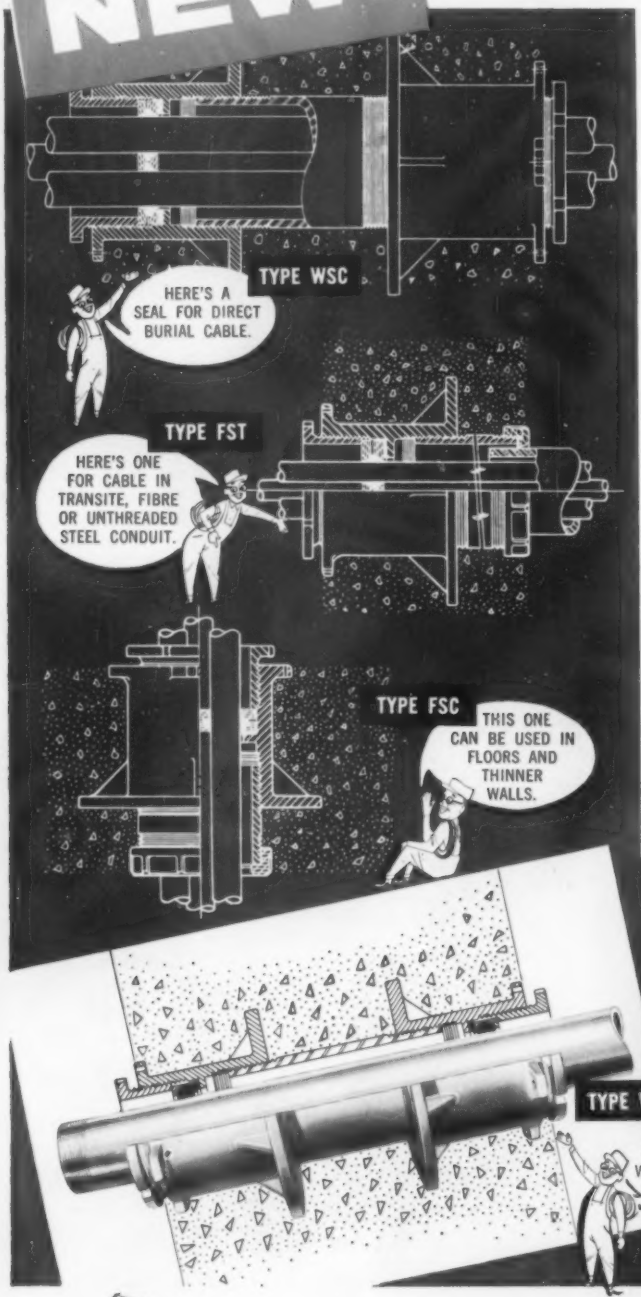
"Check-Out" Time. Here's one good reason why Ilg propeller fans run so quietly and with no vibration. Each Ilg fan blade must pass rigid "check-out" tests before being direct-connected to Ilg *self-cooled* motors.

ILG ELECTRIC VENTILATING COMPANY
2879 N. Pulaski Road, Chicago 41, Ill.
Offices in 57 Principal Cities
Member of Air Moving and Conditioning Association Inc. (AMCA)

• More Than 14,000 Products
• 135 Local Branches

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NEW! a complete line of O.Z. WATERTIGHT ENTRANCE FITTINGS for Conduit or Cable



End leakage problems once and for all! O.Z.'s new wall and floor entrance fittings for installation in concrete provide a positively watertight seal around conduit or cable at any pass-through point! Use them with threaded or unthreaded steel conduit, fibre or Transite® conduit, or exposed cables of varying number and sizes. Gland-type sealing assemblies, with pressure bushings, may be tightened at any time. Fittings accommodate conduit ranging from ¾" to 6". Standard types, sizes available from stock. Specials made to order.

For more information on fittings and other O.Z. products, call your local distributor, or write to the company.

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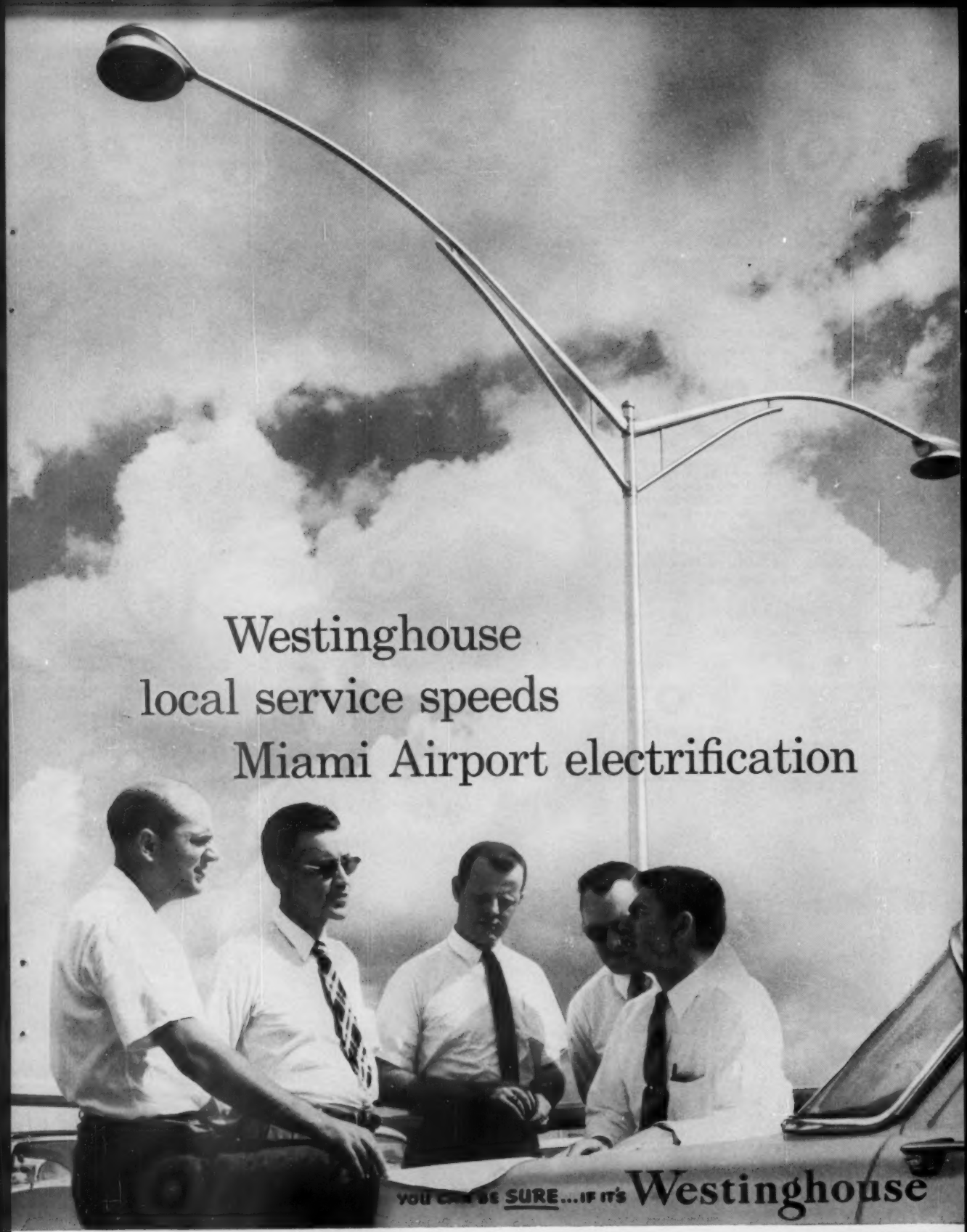
O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
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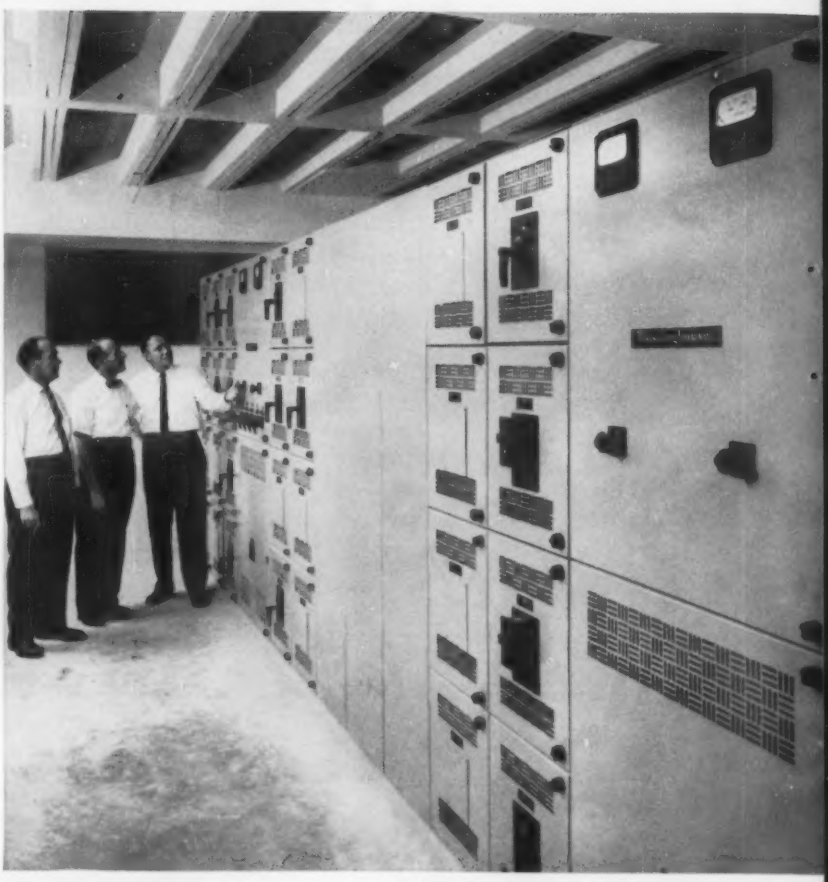
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COVER PHOTO: Westinghouse OV-25 mercury-vapor fixtures, with Westinghouse 400-watt color-corrected mercury-vapor lamps, mounted in tandem on standard with transformer base. Shield is Westinghouse design to give complete light control. Discussing airport plans are: George Smith, Howard, Needles, Tammen and Bergendoff, Consulting Engineers; A. K. Ries, Rader and Associates, Design Engineers; James L. Hyland, Westinghouse Electric Supply Co. sales representative; Charles W. Butsch, Westinghouse sales representative; and A. D. Snyder, Astor Electric Service, Inc., Electrical Contractor.

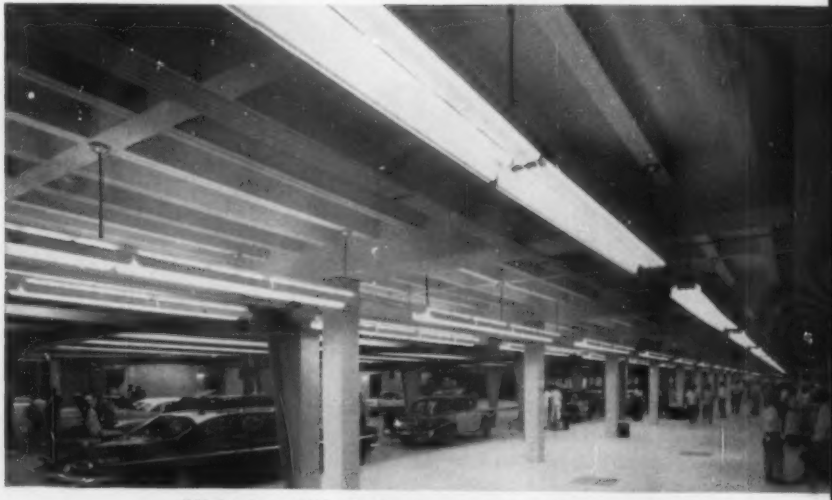


Jack E. Mitchell and Leonard Gordon of Mitchell-Gordon Associates, Design Engineers; and Charles Butsch, Westinghouse, examine Westinghouse low-voltage, metal-enclosed drawout switchgear, with Type DB-100 main breakers, DB-50 and DB-25 branch breakers, serving Consumer Service area of new airport. Standardized in design, factory-assembled, factory-wired and factory-tested, Westinghouse switchgear provides lower contractor installation costs by eliminating many on-the-job labor costs.

J-94124-2



Charles W. Butsch, with W. F. Stainton and S. R. Insalaco of Florida Power and Light Co., inspects three Westinghouse vault network transformers (Spacemiser design) which furnish power to Consumer Service Building of terminal.



Night shot of "deplaning passenger area," showing the broad expanse of walk and driveway, designed to make airport one of the most serviceable and convenient in the world. Westinghouse industrial-type lights, 2SVP-75, 4- and 8-foot lengths, give maximum light levels, require practically no service and are designed for the quickest, most economical installation.

ONE-STOP SHOPPING

Coordination of Westinghouse equipment meets needs of multiple electrical contractors and consulting engineers

Air passenger traffic in and out of Miami, Florida, moves through one of the largest and most modern central-type airports in the world—the new Miami International Airport. Developed and operated by the Dade County Port Authority, and known as the "Gateway to the Americas," this big, new facility handles more than 11,000 passengers per day.

During the planning and construction of the new Consumer Service Building and parking field at the airport, Westinghouse engineers and representatives of its local distribution outlet, WESCO, worked closely with the architects, consulting engineers, general contractors, electrical contractors and airport engineers. Westinghouse equipment was specified for the electrical distribution system and for many lighting requirements.

An important part of the construction planning was the careful coordination of electrical equipment deliveries by WESCO so the schedules of the many firms concerned could be maintained.

Westinghouse equipment included transformers, low-impedance bus duct, both light and power panelboards, circuit breakers, fluorescent lighting for indoors, and special-design airport lighting equipment for outdoors. Westinghouse electric stairways were specified to keep traffic moving smoothly from floor to floor and in and out of the terminal.

Illustrated on these pages are photos of the *(cont'd)*

YOU CAN BE SURE...IF IT'S

Westinghouse

Over 250 Pages Westinghouse Data in Sweet's Construction File.

J-94124-3



W. Robert Little of Fred Howland, Inc., General Contractors; Lamar Seay, WESCO sales representative; and Mannie Marlis, President, Atlantic Electric, Inc., Electrical Contractors, examine transformer room installation in Consumer Service Building which includes two Westinghouse 112 ½-kva, DT-3 dry-type transformers and one Westinghouse Type EPT 15-kva, 3-phase unit with circuit breaker. These smaller, lighter transformers are easily handled, quickly mounted, thereby cutting contractor installation costs.



Lamar Seay and Paul Schneider, Job Superintendent for Atlantic Electric, Inc., shown with Westinghouse air conditioning starter, Class 11-750, NS-57, 480-v for one of three 300-ton centrifugal compressors in Consumer Service Building.



Standing before Westinghouse lighting panelboards, Type NLAB, installed behind panels in lobby of enplaning passenger service area in Consumer Service Building, are Harold D. Steward of Steward-Skinner Associates, Architects; Leonard J. Gordon, Mitchell-Gordon Associates; and Charles Butsch. Contractor-Wesco coordination insured prompt delivery of boxes and interiors to meet contractor schedules.

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• 135 Local Branches

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Coordination of Westinghouse equipment meets needs of multiple electrical contractors and consulting engineers *(cont'd)*

Westinghouse electrical equipment which helped Power-Up the new Miami Airport for present and future operation, and of some of the many individuals who had a part in its planning and construction.

Westinghouse can help you with any phase of your own electrical planning and construction. See your Westinghouse distribution outlet or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

OWNER: Dade County Port Authority

ARCHITECT: Steward-Skinner Associates, Miami, Fla.

DESIGN ENGINEERS: (Outdoor) Rader and Associates, Miami, Fla.
(Indoor) Mitchell-Gordon Associates, Coral Gables, Fla.

CONSULTING ENGINEERS: Howard, Needles, Tammen and Bergendoff, Miami, Fla.

GENERAL CONTRACTOR: Fred Howland, Inc., Miami, Fla.

ELECTRICAL CONTRACTORS: (Outdoor) Astor Electric Service, Inc., Miami Beach, Fla.
(Indoor) Atlantic Electric, Inc., Miami, Fla.

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J-94124-4

ABOVE: Night view of airport ramps and parking area. BELOW: Close-up view showing upper vehicular ramps for enplaning passengers.

Advanced methods and techniques were used to prepare Miami's International Airport for its important role in the new Jet Era. An interwoven network of highways, incorporating overpasses and grade separated interchanges, assures free-flowing traffic to and from the airport. The overhead lights in the huge parking field and upper vehicular ramp have specially designed Westinghouse OV-25 units, over 370 fixtures in all. These fixtures, functional as well as decorative, combine glare-free visibility with the virtual elimination of maintenance.



ONE-STOP SHOPPING

eye·fi
RE/LIGHTING



the
sparkling
NEW
TRIUMPH
designed for
your
customers'
satisfaction

Sure, your customer buys foot-candles and styling. But he also wants ease and economy in maintenance, plus an assurance of long operating life. Complete satisfaction on all counts—*your customers' satisfaction*—has been engineered into the new Triumph.

Prismatic Lens—New Approach to Light Distribution. Controls reflected glare—yet provides all the easy maintenance features of a louvered unit. Recessed, crescent-shaped prismatic lenses, together with scientifically shaped side panels, provide balanced distribution with no objectionable brightness.

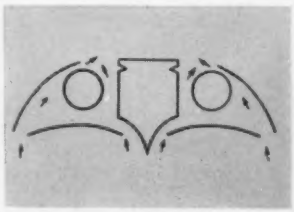
Serene Styling Blends with Architecture. Slim-trim simplicity and subdued sparkle harmonize with practically any commercial and school surroundings.

Easy to Clean—Stays Clean Longer. No dust-collecting flat areas, deep grooves or difficult corners. Curved lens repels debris. Air circulation cleanses interior. An occasional swish or two with a dust cloth keeps the Triumph looking sparkling new.

Sturdy Construction. Looks sturdy—is sturdy. Westinghouse attention to detail assures quality . . . guarantees long life.

Available with Conventional Louvers. The new Triumph can also be supplied with metal louvers.

For complete information, write Westinghouse Electric Corporation, Lighting Division, Edgewater Park, Cleveland, Ohio. J-04472



Completely Ventilated
Air flow keeps interior clean and lowers operating temperature of ballast and lamp. Curved lens repels debris.

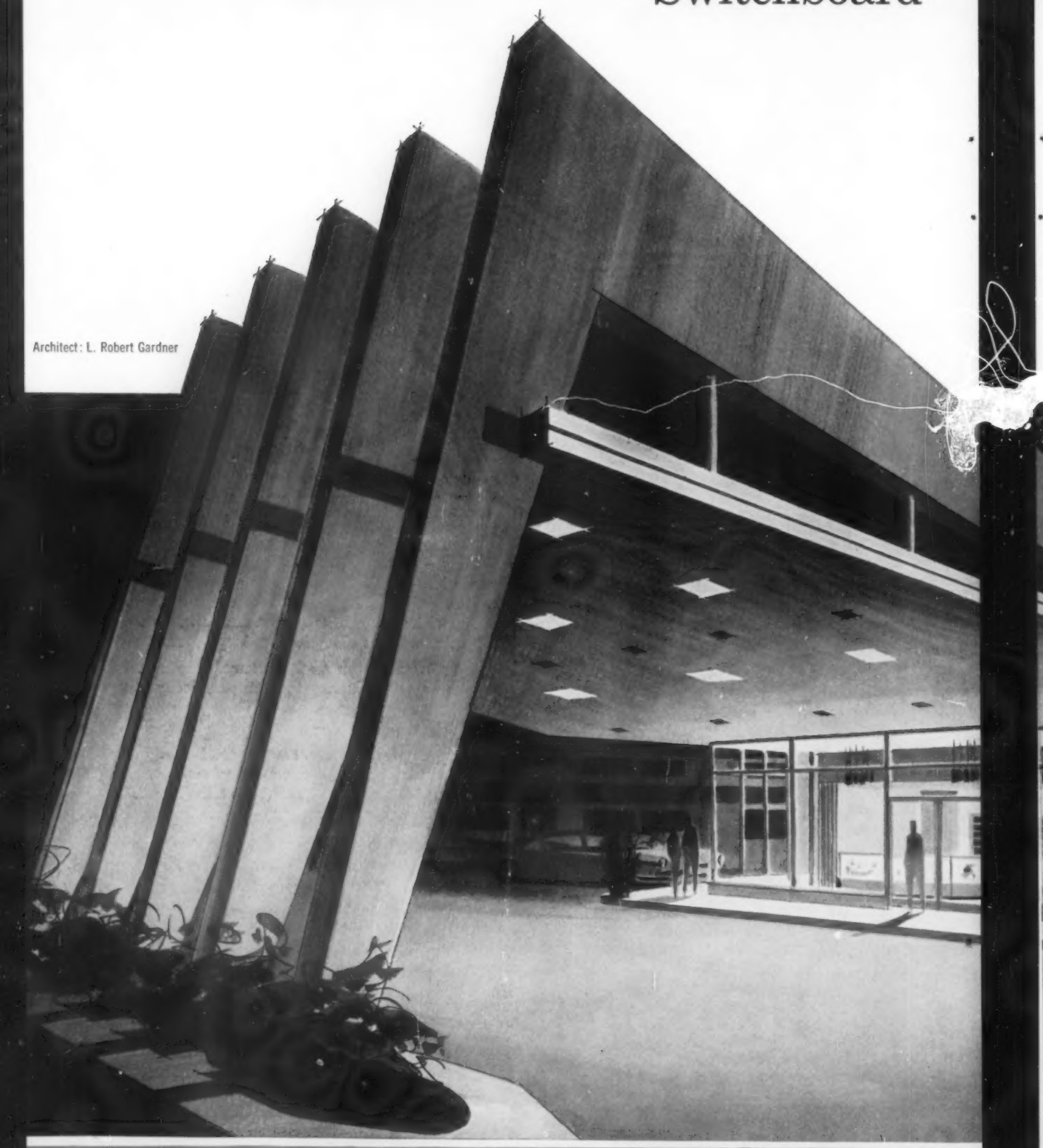
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Switchboard



Architect: L. Robert Gardner

ONE-STOP SHOPPING

planning helps Power-Up new motel

Minimum maintenance assured by all-Westinghouse system

When the Hotel Utah, Salt Lake City, first started planning for the new $3,500,000 motor lodge as an extension of already existing hotel facilities, it was agreed the electrical system should conform with that installed in the hotel.

Westinghouse equipment had already proved its excellence in Powering-Up the hotel distribution system by requiring minimum maintenance while providing maximum dependability.

"Design of the motor lodge electrical system," stated Gerald B. Smith, Superintendent of Buildings for Hotel Utah, "was based upon the desired interchangeability of its parts and equipment with that already installed in the hotel, so we would not have to deal with two different types of systems in ordering parts or performing any necessary maintenance work."

In addition to the Westinghouse building-type switchboards, there are 55 panelboards in the motel, each of which controls anywhere from 20 to 42 individual lighting and convenience outlet receptacle circuits.

Complete information is available to show how you can Power-Up your installation through the use of Westinghouse panelboards. Call your nearby Westinghouse office, or write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

OWNER: Hotel Utah, Salt Lake City
ARCHITECT: L. Robert Gardner, Cedar City, Utah
CONSULTING ENGINEERS: Blomquist & Brown, Salt Lake City
GENERAL CONTRACTORS: Jensen Construction Co., Salt Lake City
ELECTRICAL CONTRACTORS: Midwest Electric Co., Salt Lake City
WESTINGHOUSE DISTRIBUTOR: WESCO, Salt Lake City

J-93536

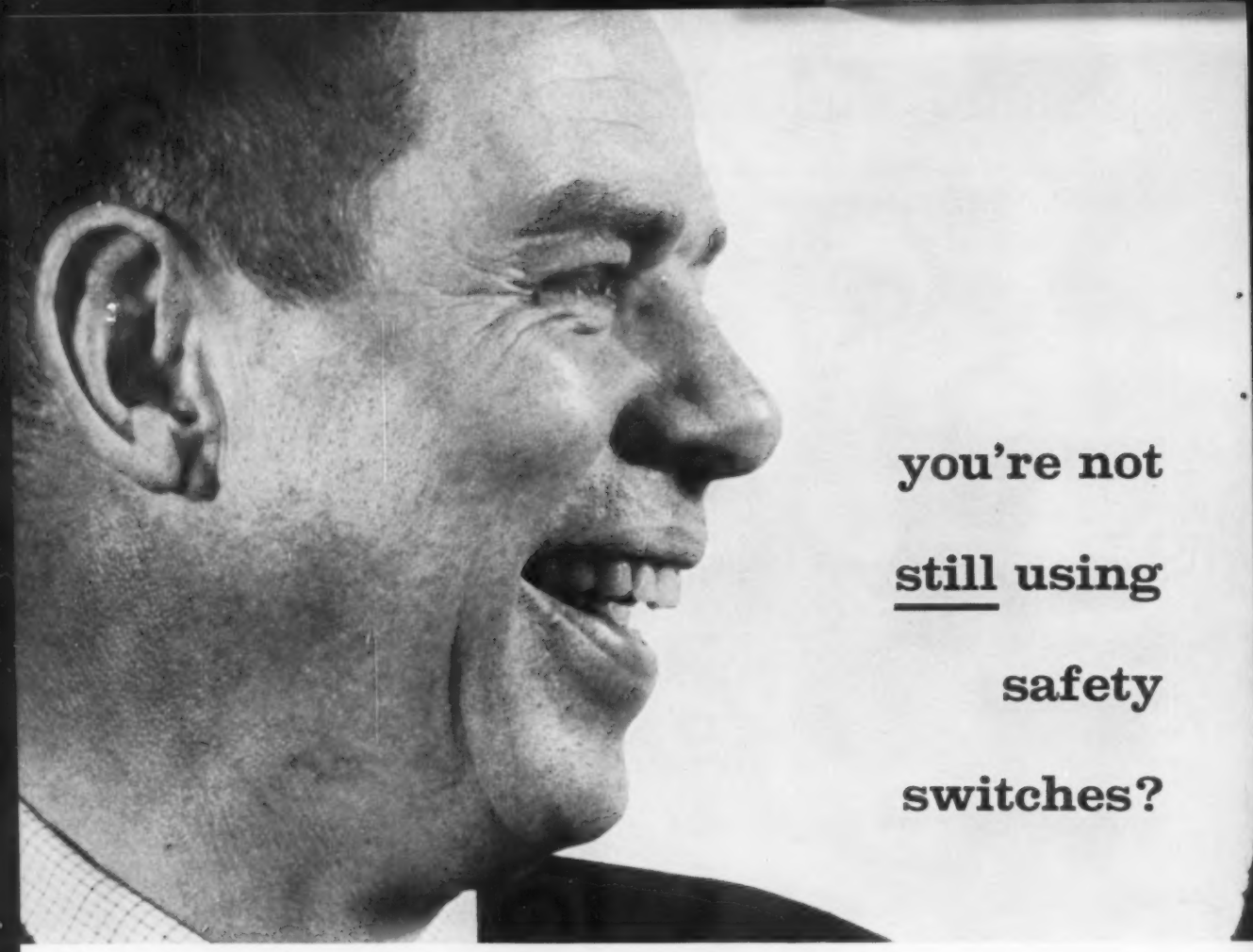


W. C. Brown and S. A. Blomquist, of Blomquist & Brown, Consulting Engineers (standing at rear), show main switchboard to Gerald B. Smith, Hotel Utah Building Superintendent, and Van Livingston, Motor Lodge Assistant Manager. This Westinghouse building-type switchboard distributes current through feeder circuit breakers to the 55 panelboards throughout the building.

YOU CAN BE SURE... IF IT'S Westinghouse

• More Than 14,000 Products
• 135 Local Branches

come in or call WESCO



you're not
still using
safety
switches?

AB-I breakers cost less,
yet give your customers
better circuit protection . . .

ONE-STOP SHOPPING



Safety switches versus AB-I breakers is an old, old controversy. Westinghouse manufactures both at their Beaver, Pennsylvania plant.

Here's their authoritative, unbiased report in the interest of better circuit protection:

Fact: AB-I's cost less. In most all motor applications, AB-I's are lower priced than an equivalent safety switch equipped with fuse. (For a rating-by-rating cost comparison, write to the Westinghouse address shown below.)

Fact: AB-I's require less mounting space. To protect a given motor size, the AB-I breaker will nearly always be smaller (up to 40% smaller, never larger) than an equivalent safety switch.

Fact: AB-I's require no maintenance. No costly fuses to replace; no production time-loss due to fuse replacements; no maintenance of any kind!

Fact: AB-I's are safer. With breaker protection, motors can't single-phase. There are no exposed live parts on an AB-I breaker to endanger workmen; no need to open the cover to reset the handle; no dangerous fuse replacements.

Fact: AB-I's are more versatile. Only with AB-I breakers can you use convenient, time- and money-saving accessories such as bell alarms, shunt-trips, auxiliary interlocks, etc.

It's a fact. AB-I breakers are the safest, surest, least costly means of circuit protection. On your next order, order the best in AB-I breakers—by Westinghouse.

J-30292-R

YOU CAN BE SURE...IF IT'S

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NOW!

Westinghouse research announces another major achievement in fluorescent lamp development!

15,000 LUMENS IN A LIGHTWEIGHT, 96-INCH SUPER-HI™ LAMP!



Through new ballast equipment and improvements in lamp design, Westinghouse engineers have increased the light output of an 8-foot S.H.O. Lamp to more than that given by *two* standard Slimline lamps. Even more remarkable, the extra bonus of light you get in these new Super-Hi™ lamps was not achieved at the sacrifice of their light weight. In fact, similarly rated fluorescents weigh about twice as much as the S.H.O.—almost *five tons* more of glass is hanging from the ceiling in a 5000 lamp installation.

Super-Hi™ lamps deliver their full light output regardless of their position in fixtures. They have a smooth, tubular surface, free from dust-catching pockets or indentations which quickly cut down the light. S.H.O.'s are rated at 7500 hours life. List price, $6.95.

YOU CAN BE SURE... IF IT'S

ONE-STOP SHOPPING

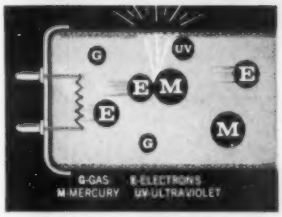
Only Westinghouse brings you these

6 LIGHT-BOOSTING ADVANCES

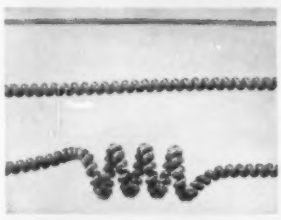
1. ULTRALUME™ PHOSPHORS. Westinghouse research has proved that the size of the individual phosphor particles which coat the inside of a fluorescent lamp have a direct effect on the amount of light given off. Research has determined a definite range and distribution of particle size. Now, a new and exclusive Westinghouse process selects particles within the range for more efficient light-producing phosphors.



2. MIXED GASES. All fluorescent lamps contain mercury and gases. The gases serve as conductors until the mercury is vaporized. The combination of these gases and mercury vapor then converts electricity into ultraviolet radiation, which, in turn, causes the phosphors to "fluoresce," or light up. Westinghouse engineers have determined that a carefully proportioned mixture of several rare gases produces the best results. Westinghouse uses the right mixture and pressure for each type of fluorescent lamp.



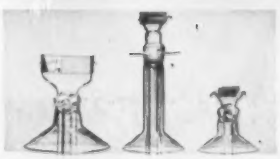
3. TRIPLE COILED ELECTRODES. When a fluorescent lamp is turned on there is a sudden initial bombardment of the electrodes by heavy mercury ions. To reduce this bombardment the emission material which coats the electrode must be heated. If the emission material is not protected, lamp life will be shortened. Westinghouse uses triple wound coils to make sure that the carefully determined amount of emission material is heated quickly and is adequately protected from bombardment.



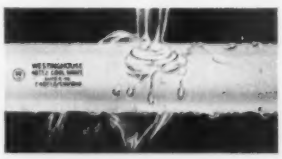
4. PLATED LEADS. The terrific electron bombardment which takes place inside a fluorescent tube eventually causes particles of the metal supports and leads to sputter off and cause "end blackening." To prevent this, Westinghouse plates the lead wires with super-hard Chrome-Vanadium. Result: tubes that *stay* brighter, end to end.



5. "CUSTOM" ANODES. Anodes act as buffers to cushion the terrific shock of electron bombardment and prevent excessive "sputtering" of emission material from the electrodes. Since the electrical characteristics are different for each type of fluorescent lamp, Westinghouse anodes are especially engineered to fit the electrical requirements of each type of lamp.



6. SILICONE "RAINCOATS". Moisture is the invisible enemy of fluorescent lamps. In high-humidity areas, moisture can collect on the exterior surface of the lamp and prevent it from starting. To protect against moisture accumulation, Westinghouse fluorescents are given a special Silicone coating, or "raincoat," which disperses this film into harmless droplets.



You get

MORE LIGHT PER DOLLAR

from Westinghouse

2800 LUMENS
(cool white)



IN THE NEW "UNIVERSAL" PREHEAT-RAPID START LAMP . . . Now you can greatly simplify ordering, stocking and maintenance by specifying this one lamp for the job that two different types have been doing! Specially designed electrodes allow you to use this 40-watt lamp on either your present rapid start or preheat circuits with no loss in lumen output. And prices have been reduced to only $1.25 list—5¢ less than old-style Rapid Start Lamps!

9000 LUMENS
(cool white)



IN THE BRIGHTEST 96" HIGH OUTPUT LAMP YOU CAN BUY . . . Light output improved 23% over present H.O. type (High Output) lamps to make this the most economical 96" H.O. type lamp ever developed for application where high output lamps are used . . . 9300 lumens in white and warm white. This brightest of all 96" H.O. type fluorescents is rated at 7500 hours life—more than 2 years actual use in the average installation—and they're designed to operate on present 96" H.O. ballasts.

3200 LUMENS
(cool white)



IN THE HIGHEST-RATED 40-WATT LAMP . . . Get 21% more light using your *present* fixtures . . . 3310 lumens in white and warm white! This new lamp is the only fluorescent with no "lazy ends"—even the *bases* let light through (optional at slight extra cost). Life rated at 7500 hours at 3 hours per start. List price, $1.45.

CONTACT YOUR LOCAL WESTINGHOUSE LAMP AGENT, OR WESTINGHOUSE LAMP DIVISION, BLOOMFIELD, N. J.

Westinghouse

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Fashion Plate

from BRYANT



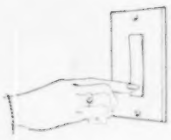


Exciting new idea in wall switches

Lets the builder or owner match, blend or contrast any decorating scheme



ONE-STOP SHOPPING



TAP-EEZ . . . new tap-action, flush-mounted switch for buildings, institutions and stores. Rugged enough for all a-c applications, yet much more attractive than ordinary switches.

WINS NEW CUSTOMERS . . . CAPTURES MORE BUILDER DOLLARS

Fashion Plate opens the door to more business in new construction . . . for homes, buildings, institutions . . . brings you a bigger share of the total building dollar

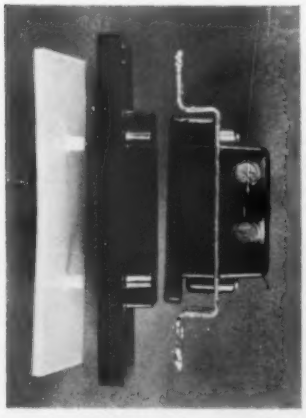
There's real excitement about Fashion Plate* among builders and architects. They are taking a second look at wall switches. That means you'll see Fashion Plate in more and more specifications . . . in more and more new homes and buildings. And you are the one who profits.

Right now, builders all over the nation are being supplied with a brand-new merchandising package for Fashion Plate. And they are being sent to you to supply their wiring needs.

Don't wait. Stock up now before the big building rush this summer. Next job you wire, suggest Fashion Plate. It's an exciting new product that wins customers and builds profits.

*Trade-Mark

ASK YOUR BRYANT DISTRIBUTOR for a sample of Fashion Plate. Take it apart and see the built-in quality . . . the trade-mark of Bryant superior wiring devices.

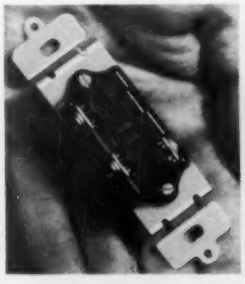


UNLIMITED APPLICATIONS—AVAILABLE IN SINGLE, DOUBLE AND THREE GANG COMBINATIONS—WITH CLEAR OR IVORY ACTUATORS, BLACK OR WHITE BACK PLATES

Smooth, quiet action. Low installation cost. Just press on back plate and actuator.



Silver alloy contacts insure long life. Positive controlled contact action. Listed by Underwriters' Laboratories, Inc.



Compact design. Fits standard switch boxes. Requires no special wiring.



Time-saving, clamp-type, back wiring terminals make installation quick and easy.

Fashion Plate

The exciting things come from

BRYANT

THE BRYANT ELECTRIC COMPANY, BRIDGEPORT 2, CONNECTICUT

J-99024

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Westinghouse Life-Line A motors save $200 a year in rewinding costs alone

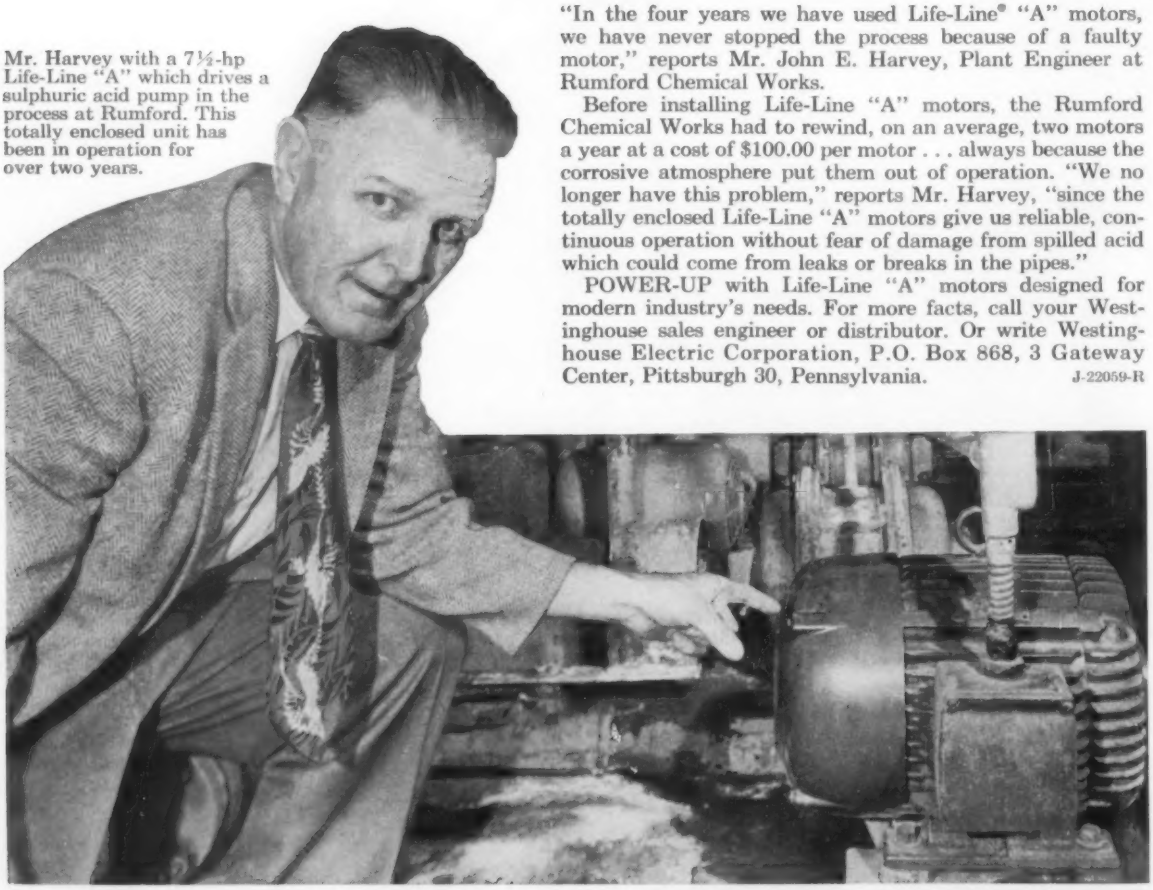
...at Rumford Chemical Works, Rumford, R.I.

Westinghouse motors are reliable for 24-hour, 7-day week operation in sulphuric acid manufacture

"In the four years we have used Life-Line® "A" motors, we have never stopped the process because of a faulty motor," reports Mr. John E. Harvey, Plant Engineer at Rumford Chemical Works.

Before installing Life-Line "A" motors, the Rumford Chemical Works had to rewind, on an average, two motors a year at a cost of $100.00 per motor . . . always because the corrosive atmosphere put them out of operation. "We no longer have this problem," reports Mr. Harvey, "since the totally enclosed Life-Line "A" motors give us reliable, continuous operation without fear of damage from spilled acid which could come from leaks or breaks in the pipes."

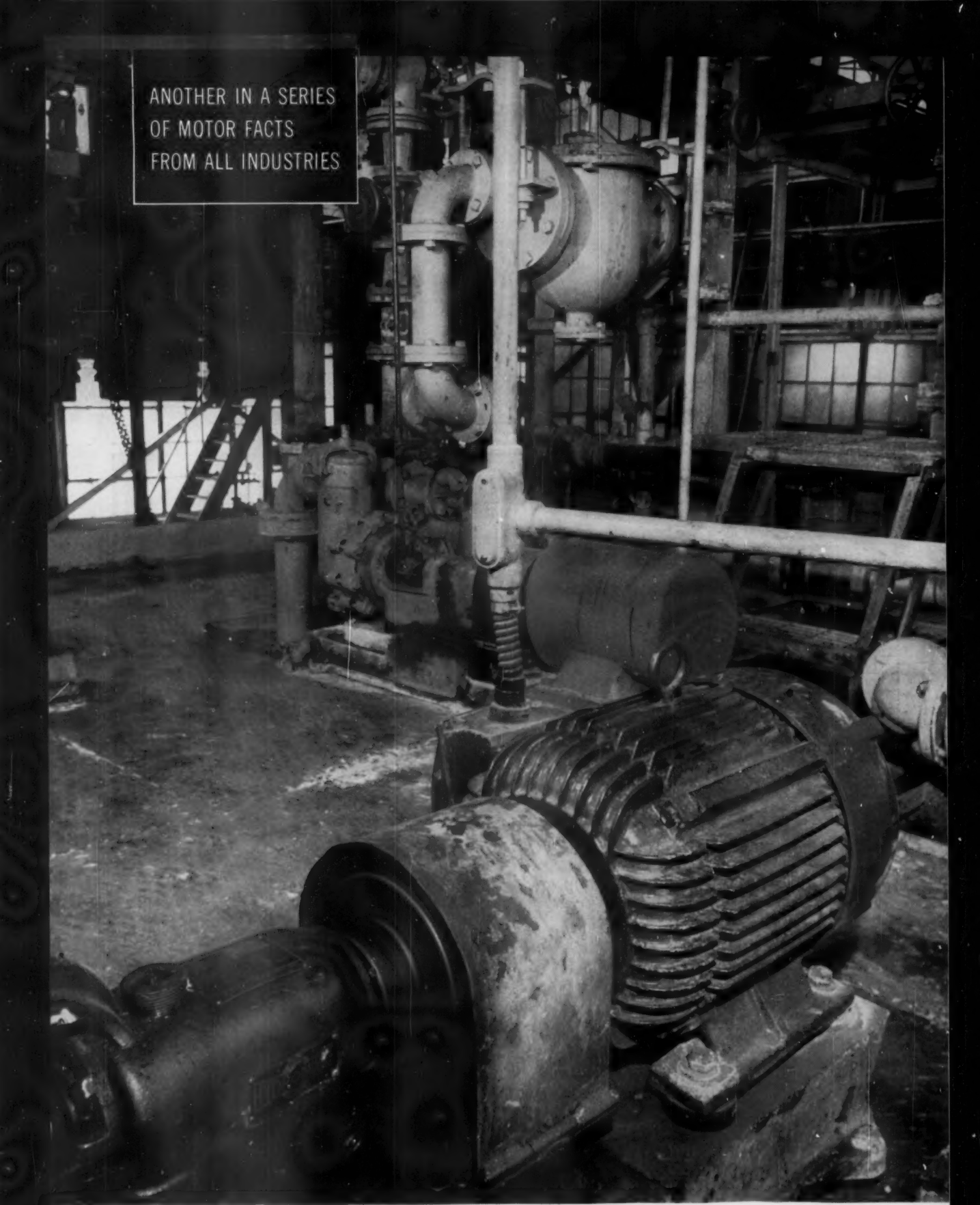
POWER-UP with Life-Line "A" motors designed for modern industry's needs. For more facts, call your Westinghouse sales engineer or distributor. Or write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-22059-R



Mr. Harvey with a 7½-hp Life-Line "A" which drives a sulphuric acid pump in the process at Rumford. This totally enclosed unit has been in operation for over two years.

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HOW THE ALUMINUM IN K/W INTERLOCKED ARMOR CABLE SAVES YOU MONEY...SPEEDS YOUR JOB

K/W 3 Conductors Interlocked Armor Cable Spec. 808-S vs. 3 Copper Cdrs. in Steel Conduit
COST AND WEIGHT COMPARISON—1000 FT.

600V RHW 75°C RUBBER 3 Copper Cdrs. in Steel Conduit							600V ALUMINUM INTERLOCKED ARMOR Aluminum Conductors, 90°C, Butyl Insulation						SAVINGS WITH ALUMINUM				
Wire Size	Amps.*	CONDUIT Trade Size In.	CONDUIT O.D. Inches	Area Sq. In.	Total Wt.—Lbs.	Total Cost—$	Wire Size	Amps.**	O.D. Inches	Area Sq. In.	Total Wt.—Lbs.	Total Cost—$	% Bonus Ampacity Alum. over Copper	SAVINGS (1) $	SAVINGS (1) %	Weight Savings Lbs.	Space Savings %
2	115	1¼	1.66	2.17	2,860	903.	1	120	1.44	1.63	850	713.	4.3	190.	27	2,010	25
1	130	1½	1.90	2.82	3,570	1,155.	1/0	135	1.53	1.84	960	806.	3.8	349.	43	2,610	35
1/0	150	2	2.38	4.44	4,660	1,457.	2/0	160	1.63	2.07	1,115	926.	6.7	531.	57	3,545	53
2/0	175	2	2.38	4.44	4,960	1,609.	3/0	180	1.74	2.38	1,285	1,093.	2.9	516.	47	3,675	46
3/0	200	2	2.38	4.44	5,350	1,814.	4/0	205	1.87	2.74	1,550	1,265.	2.5	549.	43	3,800	38
4/0	230	2½	2.88	6.51	7,730	2,508.	250	230	2.04	3.27	1,840	1,522.	0	986.	65	5,890	50
250	255	2½	2.88	6.51	8,190	2,883.	300	255	2.16	3.66	2,080	1,751.	0	1,132.	65	6,110	44
300	285	2½	2.88	6.51	8,700	3,171.	350	285	2.27	4.04	2,325	1,870.	0	1,301.	70	6,375	38
350	310	3	3.50	9.62	10,860	3,752.	400	305	2.37	4.41	2,560	1,998.	–1.6	1,754.	88	8,300	54
400	335	3	3.50	9.62	11,370	4,053.	500	355	2.56	5.14	2,990	2,260.	6.0	1,793.	79	8,380	46
500	380	3	3.50	9.62	12,390	4,748.	600	395	2.79	6.11	3,545	2,615.	3.9	2,133.	82	8,845	36
700	460	3½	4.00	12.57	15,930	6,459.	750	455	3.02	7.16	4,175	3,151.	–1.1	3,308.	105	11,755	43

* Based on 1956 N.E. Code ** 90°C Conductor—40°C Ambient. Note—Comparison of 75°C RHW and 90°C Butyl K/W Spec. 107. Current prices, 4-29-59.
(1) Savings based on increased cost of copper and steel over aluminum cable. Weights and prices for 1000 ft.

1. LESS COST

You realize important savings on *materials* with KW Aluminum Interlocked Armor Cable because (1) it gives you greater current-carrying capacity per dollar, (2) the nature of its aluminum armor eliminates costly conduit. Also, you save on *costly labor* because KW's corrosion resistant aluminum armor holds upkeep to a minimum, even in highly corrosive areas.

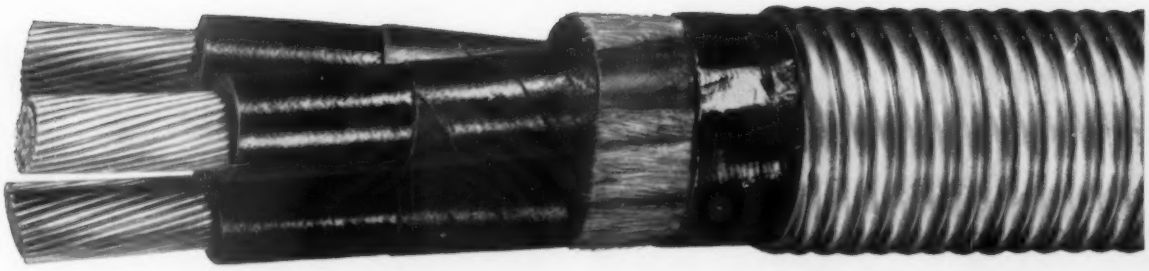
2. LESS WEIGHT

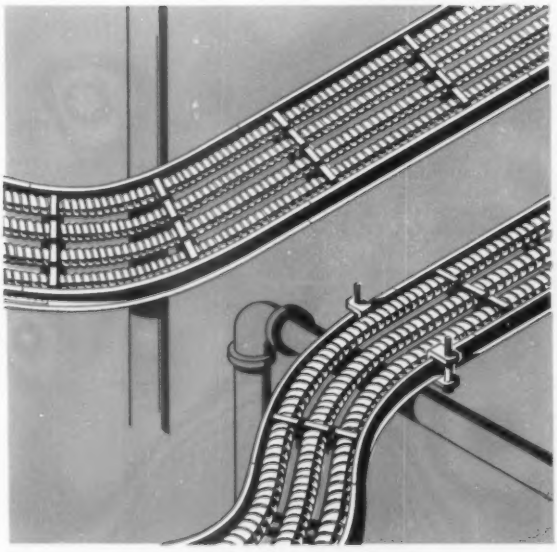
Any interlocked armor weighs far less than heavy, bulky steel conduit. But KW gives you *additional* weight savings because its armor is aluminum—weighing only ⅓ as much as steel or bronze. Moreover, because the conductors are also made of aluminum, they are less than half the weight of copper conductors that carry the same amount of current.

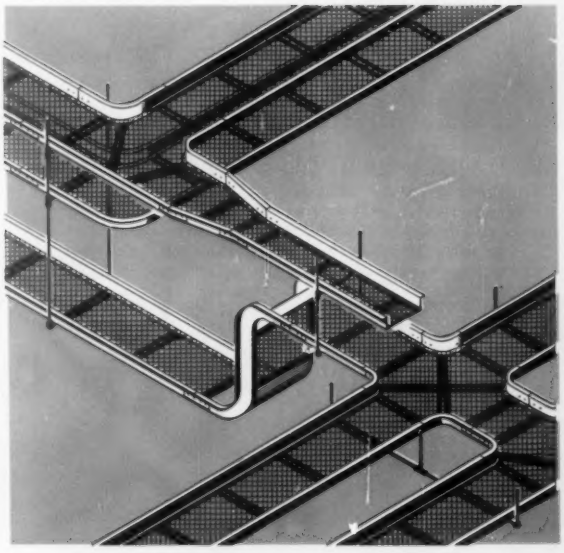
Versatile Use. KW Aluminum Interlocked Armor Cable is the ideal answer for industrial and commercial distribution systems, generator leads and auxiliary cable installations.

KW Aluminum Interlocked Armor Cable is available at your nearest Wesco office.

ONE-STOP SHOPPING







3. FASTER INSTALLATION

The light weight and supreme flexibility of KW Aluminum Interlocked Armor Cable mean easier handling, cut installation time in half. It can easily be bent horizontally or vertically around impeding objects and laid in longer lengths, eliminating the need for frequent splicing. In addition, because its diameter is less than conventional conduit systems, compact KW cable can bring space savings of up to 54%.

4. SPEEDIER MODIFICATIONS

KW Aluminum Interlocked Armor Cable may be laid on readily accessible racks, trays and troughs . . . or hung from a messenger. It is a quick and simple matter to expand KW Interlocked Armor Cable systems to meet increased power requirements which may arise after installation.

KAISER ALUMINUM

"If It Carries Current, KW Carries It!"

See "MAVERICK" • Sunday Evenings, ABC-TV Network.
Consult your local TV listing.

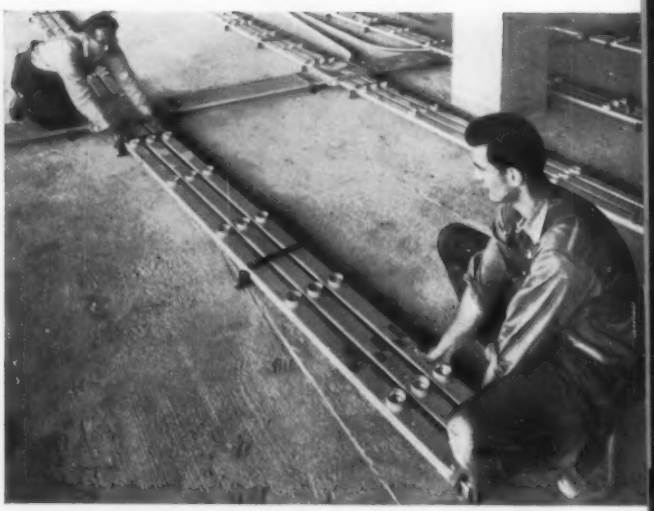
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come in or call WESCO

Here's what top electrical contractors say about easily-installed SPANG raceways:



M. B. FOSTER ELECTRICAL COMPANY, BOSTON. General Superintendent Vern Santas reports, "This combination of *SPANG Headerduct* and cellular flooring is the most progressive step in electrical distribution in 25 years. Our men shown here on the National Life Building job work in teams for fast, accurate installations." SPANG representative trained installation crew on the job.



PATTERSON-EMERSON-COMSTOCK, INC., SAN FRANCISCO. According to Job Superintendent Reave A. Tague, "The *SPANG Underfloor Duct* system we installed in the San Francisco State Office Building meets all today's needs . . . and provides for inexpensive future expansion. We prefer SPANG Underfloor Duct, because the number of component parts are few, and all fit together easily."



J. LIVINGSTON AND COMPANY, DETROIT. John C. Gnass, Job Superintendent, states, "We estimated a savings of 25% installation time using *SPANG Headerduct* in the new main office of the National Bank of Detroit. Two exclusive features of the SPANG junction box made this possible: corner leveling screws for fast, easy adjustment; and square openings for more working area."



WALTER J. BARNES ELECTRICAL COMPANY, NEW ORLEANS. Walter J. Barnes, Proprietor, says, "*SPANG Underfloor Duct* offers ease of handling and installation. For Moisant International Airport extension we installed SPANG Underfloor Duct to handle the power and telephone wiring. Particularly we liked the carefully-designed junction boxes, which eliminated installation errors."

You, too, can have flexible, modern electrical installations . . . with either SPANG Headerduct or Underfloor Duct. For complete details on design and installation procedures, call your local SPANG Representative, or write to the National Supply Company, Two Gateway Center, Pittsburgh 30, Pennsylvania.

SPANG UNDERFLOOR DUCT

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

ONE-STOP SHOPPING

HERE ARE 11 GOOD REASONS WHY SPANG STEEL CONDUIT IS YOUR BEST BUY

1. **High strength** . . . SPANG Conduit resists crushing and mechanical injury from rough treatment at job site better than other types of raceways.

2. **Uniform throughout** . . . bends easily . . . no hard or soft spots . . . quickly and accurately threaded . . . saves installation time.

3. **Smooth interior finish** . . . uniform hard surfaces for easy, trouble-free wire pulling. No obstructions, no burrs to damage wires.

4. **Exceptional corrosion resistance** . . . hot-dipped, heavy-duty galvanized finish and lacquer coating are highly resistant to moisture, cracking, peeling or flaking. No special coating needed for embedding in concrete.

5. **Clean threads** . . . uniform, no burrs. Specially-prepared coating helps prevent rust formation.

6. **Vibration resistant** . . . combination rigid steel conduit, threaded couplings and fittings is inherently strong and vibration resistant.

7. **Excellent electrical characteristics** . . . greater conductivity than needed under worst grounding conditions. High resistance to arcing, short circuiting. Unaffected by contact with dissimilar metals.

8. **Tested and inspected** . . . Preece Test and bending test applied to samples from each lot. Each length inspected for uniformity and straightness.

9. **Color coded for size identification** . . . colored thread protectors on each length of conduit save you time in inventory, at job site.

10. **Bundled with steel strapping** . . . in sizes ½" through 1½" for added safety and convenience in handling, transporting, storage.

11. **Approved** . . . by Underwriters' Laboratory, Inc. Meets all Federal and ASA specifications.

That's the story on SPANG Steel Conduit. But best way to prove that SPANG is your best conduit buy is to try it on your next installation. Your local SPANG Distributor will be glad to serve you. Give him a call!

SPANG® CONDUIT

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

• More Than 14,000 Products
• 135 Local Branches

come in or call WESCO



WHO SAYS CONDUIT IS CONDUIT?

Some frank comments by R. G. McIlroy, president of leading conduit manufacturing company

"Too many contractors and specifiers, unfortunately, think that all conduit is alike—that they needn't concern themselves about how one brand differs from others. After all, the price for conduit is pretty much the same for all makes, and isn't this a sign that conduit is just conduit? Or is it?

WHAT ABOUT "HIDDEN" COSTS?

We're all so busy with day to day problems and long-range planning that we often overlook many of the "hidden" costs that are right under our noses. These costs—costs we never figure on—are the ones that eat up net profits!

So take a few more minutes. Let me tell you how careful purchasing of a standard commodity like rigid electrical conduit can save dollars and help produce a profit on a close-figured job.



WHAT ABOUT RUST IN STORAGE?

On almost all electrical construction projects, conduit is stored at the job site so that it's available to the electricians when it's needed. But, have you ever looked at some of this stored conduit after it's been around for several weeks? You should. The rust on the conduit represents an actual job cost to you (and, incidentally, causes concern to the owners about the quality of the materials and workmanship in his new building).



CLEANING THREADS COSTS MONEY!

It takes time to clean the conduit—especially the threads. And the extra labor expended in chasing threads should be of real concern when you consider that an electrician's time is worth at least 6¢ a minute. And rust can't be ignored if the coupled connections are to look good and be workmanlike.



EXTRA HANDLING COSTS MONEY!

Moving anything unnecessarily, costs money. Why double your handling costs to clean rusty conduit? It's not required when Pittsburgh Standard is on your job. Do your electricians, locknut in hand, have to hunt for the correct size? Our color-coding means positive size identification in an instant.

"HIDDEN" COSTS CAN BE AVOIDED

As the only company devoted exclusively to the manufacture of electrical conduit, we at Pittsburgh Standard have made it our business to solve these problems and eliminate "hidden" costs. We've done it by pioneering all the major improvements—and since we produce conduit with these features in two most modern, automated plants in the industry, we can sell it *at no extra purchase cost to you!*

What are the features of Pittsburgh Standard Conduit that save you money?

1. **Hot-Dip Galvanized Conduit with Hot-Dip Galvanized Threads**
   The *only* process with the same protective zinc coating inside, outside and on threads.
2. **Zinc Chromate Coating**
   This actually doubles the protective life of the galvanizing.
3. **Color-Coded Thread Protectors**
   These not only protect the threads, but simplify and speed up selection of size. Quarter-inch sizes are red; half-inch sizes are black; inch sizes are blue.
4. **Color-Coded Bundling Tapes**
   All conduit of a given size is bundled by easy-to-handle plastic tape and color-coded, same as protectors, for further ease of handling.
5. **Master Lifts**
   This is the way we ship larger quantities—accurate counting and easier, quicker handling.

Only Pittsburgh Standard Conduit combines all 5 money-saving features

Ask for it, specify it, and find out why, for over 50 years, it's been considered "The Standard of the Trade."

RIGID STEEL CONDUIT • RIGID ALUMINUM CONDUIT
EMT • ELBOWS • COUPLINGS • FITTINGS

PITTSBURGH STANDARD CONDUIT CO.

PLANTS AT VERONA AND MORRISVILLE, PA.

ONE-STOP SHOPPING

Simplify interlocked armored cable installations



WITH NEW T&B FITTINGS

Each size of the new T&B Interlocked Armored Cable Fittings accommodates twice the previous range of cable sizes. They eliminate the problem of armored cable OD that is too large or too small for the fitting. The extra armor stop in T&B Interlocked Cable Fittings and the independently-bolted twin saddles make it possible to accommodate a wide range in armor diameters. The saddles are serrated for positive grip.

For dry or wet locations – T&B Armored Cable Fittings are available for both terminating in boxes or dead-ending, in both dry and damp locations. (Damp location fittings have a neoprene bushing, retainer ring and gland nut to keep out moisture.)

Other advantages: **1)** Fewer connectors are required to accommodate the full range cable sizes. Fewer items in stock. **2)** There is only one connector for each hub thread size. **3)** The basic connector and its accessories are engineered to achieve LOWEST INSTALLED COST.

All T&B products available only through authorized T&B distributors

THE THOMAS & BETTS CO.

T&B ENGINEERED

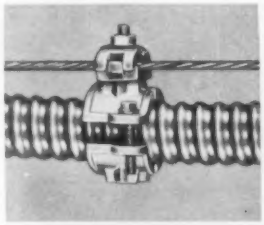
34 Butler Street, Elizabeth 1, New Jersey
Thomas & Betts, Ltd.,
Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

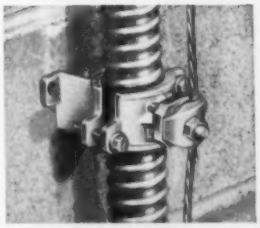
THE BASIC FITTING . . .
and T&B accessories readily solve specific installation problems . . .

FOR WET LOCATIONS

FOR GROUNDING



FOR HORIZONTAL SUPPORTING



FOR VERTICAL SUPPORTING

For complete details, with case histories on how these new T&B fittings have solved the problems of others, we will be pleased to have you participate in our informative "Eyeopener" mailing program. Simply fill out and return the coupon below.

The Thomas & Betts Co., Inc., Butler St., Elizabeth 1, N. J.

Please include my name for your "Eyeopener" series about T&B Interlocked Armored Cable Fittings.

T&B ENGINEERED

My name _____

Title _____

Company name _____

Street _____

City & State _____

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ELECTRICITY builds---JOBS...



"DEKORON-COATED" E.M.T.

"Dekoron®-Coated" E.M.T., the plastic armored raceway recommended for use in severe corrosive conditions of service outlasts standard conduit 10 to 1. Easy to install, requires no special tools, no special fittings.



GALVITE RIGID STEEL CONDUIT

GALVITE® (Blue Label) heavy wall galvanized conduit has a special coat of baked-on lacquer inside and out for corrosion-resistance and long life.



ENAMELITE RIGID STEEL CONDUIT

ENAMELITE® (Red Label) heavy wall conduit is protected inside and out with a baked-on coating of tough, wear-resistant enamel for greater protection against moderate corrosive action.



REPUBLIC ELECTRUNITE E.M.T.

Brand new on-the-job benefit built-in . . . Republic ELECTRUNITE® E.M.T. with exclusive SILVERSLICK inside finish makes wire-pulling up to 37% easier. Wire pushing is easier, too. This new product improvement combined with ELECTRUNITE's exclusive "INCH-MARKS"® for easier measuring, and "GUIDE-LINES" for easier bending are all reasons why . . . the *best* now costs *even less* installed.

ONE-STOP SHOPPING

Republic builds, too

Here's dramatic proof: Contracts have been let for new production facilities to meet your increasing demand for Republic ELECTRUNITE® Electrical Metallic Tubing.

Republic is building production capacity for the future. On your future jobs, use Republic ELECTRUNITE E.M.T. or Rigid Steel Conduit, as well as Republic's plastic armored raceways.

Because . . . THE BEST COSTS LESS INSTALLED.



"DEKORON-COATED" RIGID STEEL CONDUIT

"Dekoron-Coated" Galvite Rigid Steel Conduit—the heavy wall raceway that shrugs off corrosion. Tough coating of polyethylene encases the conduit in an end-to-end armor for protection against severe corrosion.



REPUBLIC BENDING TOOLS

Republic Bending Tools are designed and engineered to help the contractor make accurate predetermined bends in Republic raceway installations. Avoid costly "wows", wasted time, and wasted material.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
DEPT. C-6888 C
212 EAST 131st STREET • CLEVELAND 8, OHIO

Please send additional information:

☐ Republic ELECTRUNITE E.M.T. with SILVERSLICK Finish
☐ Republic ELECTRUNITE "Dekoron-Coated" E.M.T.
☐ "Dekoron-Coated" Rigid Steel Conduit ☐ GALVITE
☐ ENAMELITE ☐ The Bending System, Booklet S-D

Name_____ Title_____

Company_____

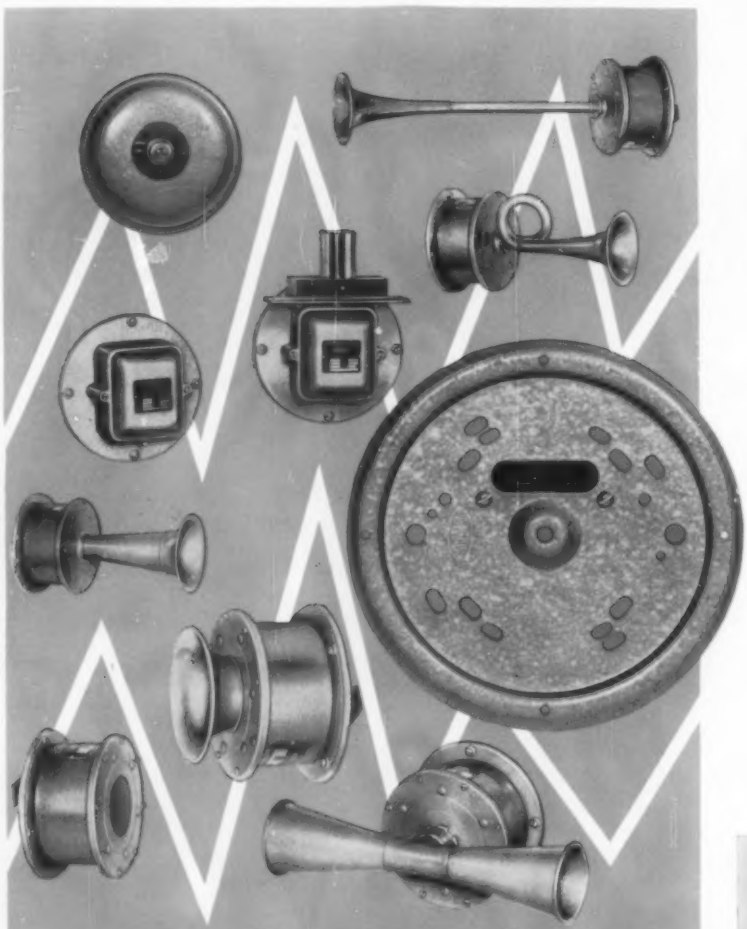
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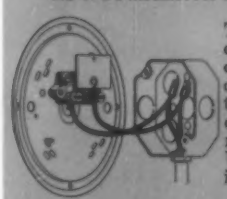
INTERCHANGE SIGNALS QUICKLY, EASILY...



THE UNI-PACT ADAPTER PLATE WILL ACCOMMODATE ALL THESE SIGNALS

- **HORNS,** all types: megaphone, short projector, two-way projector, drum style or Kodaire with straight or loop projector.
- **BELLS,** 6" and 10" sizes, single stroke and vibrating models.
- **BUZZERS** • **CHIMES**

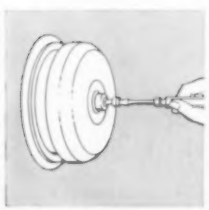
AC or DC models. For surface mounting, or panel or switchboard installations.



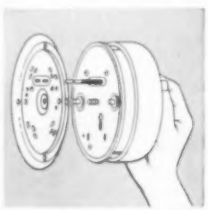
The Uni-Pact Dead Front Adapter Plate is designed for easy mounting over a standard outlet box, wire-mold or condulet. Wires are connected to the back. There are no exposed terminals on the front, so signals can be interchanged in complete safety. On new work, the rough-in men can complete connections to the Uni-Pact plate and the signals can be plugged in later, when danger of damage is over.

One Uni-Pact Adapter Plate fits 12 different signals

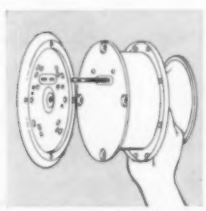
Before you buy another signal, consider the tremendous advantages of a Uni-Pact installation. This unique adapter plate permits almost instant interchangeability of any of a dozen different signals. This is important where noise levels may change. For example, a room that was formerly an office may be converted into a machine shop. The soft chime, that was formerly satisfactory, cannot be heard above the clank of metal or whining of machinery. With Uni-Pact, you merely pull out the chime and install a bell or horn. And this can be accomplished with nothing more than a screwdriver and without requiring the services of experienced, expensive electricians. Here are the four easy steps for quickly interchanging Uni-Pact signals:



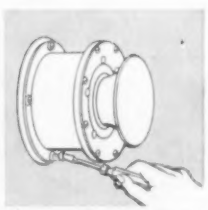
The retaining screw is loosened...



the old signal is pulled out...



the new signal is plugged in like a toaster...



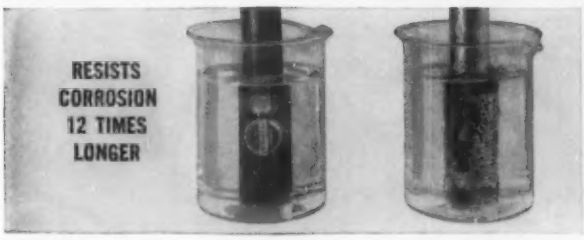
the retaining screws are tightened and the job is finished in just moments.

The largest, most complete line of signals and accessories in the industry.

SF FARADAY *Sperti Faraday, Inc., Adrian, Michigan*

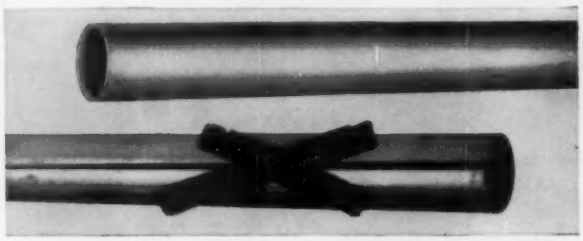
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NEW! BETTER! BEST! FROM NATIONAL ELECTRIC!



SHERARDUCT

Acid bath torture test proves superiority. Double protection: It's Sherardized (exclusive zinc process to galvanize in *depth*)! It's coated inside and out with MVC-1 (exclusive polyvinyl chloride resin that lasts and lasts)!



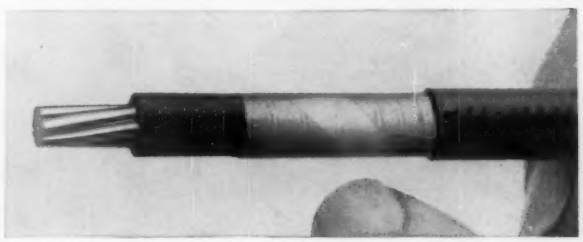
XDUCT JUNIOR

Quality control eliminates splits and high seams. E.M.T. with automated electronically-inspected production. Electrogalvanized outside surface. Aluminum enamel coating inside and out. Easy fishing. Superior bending. Silvery color.



NEW! 15,000 SERIES HEADERDUCT

Largest available capacity. A full 20.294 square inches of wiring area. Provides 100% accessibility to any or all cells in cellular steel floors. Handles largest phone cables. A complete system for cellular floor construction.



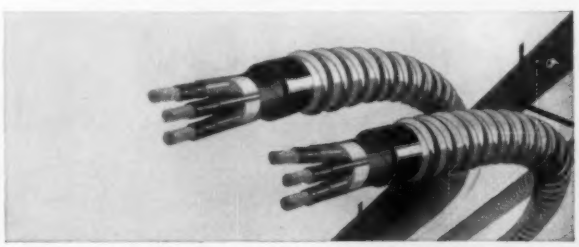
MYLAR® TAPED BUILDING WIRE

Four times the abrasion resistance of rubber-filled tape. Highly resistant to flexing. High dielectric strength. Withstands action of acids, alkalies, moisture, and oxidation. Smaller diameter. *Dupont "Mylar".



NEPCODUCT

New junction box is quickly brought into alignment with finished floor even after concrete has set. Leveling adjustment can be made with screwdriver without removing cover plate. Lazy susan interior partition can be relocated in case box should be inadvertently installed in incorrect position.



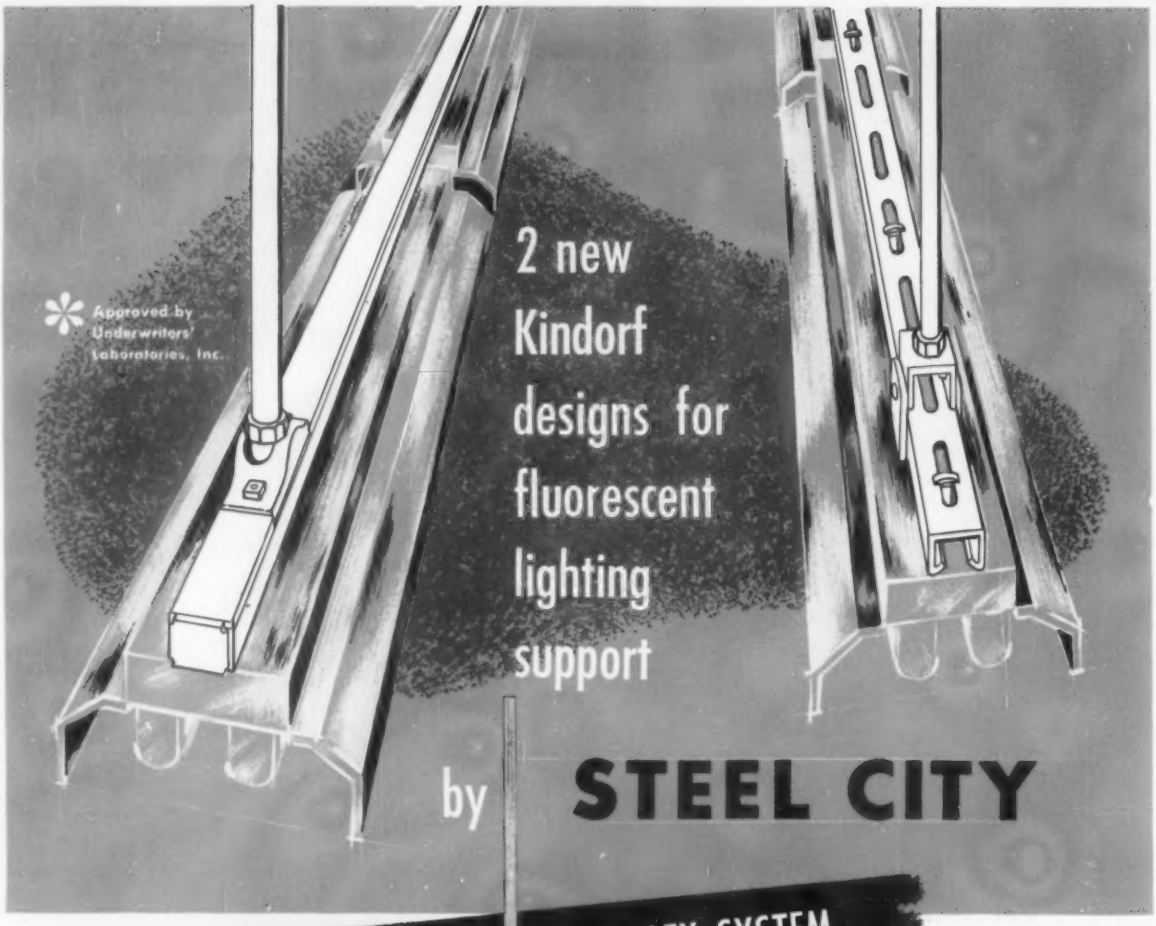
NEPCO-LOK INTERLOCKED ARMORED CABLE

Outstanding flexibility cuts installation costs. Installed quickly around corners and projections. Economically relocated for changing power needs of the future. 600-5,000 or 15,000 volt . . . one, two, three or four conductor assemblies.

NATIONAL ELECTRIC DIVISION PORTER **H.K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; PEERLESS ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Canada, Refractories, "Disston" Tools "Federal" Wires and Cables "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

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* SURFACE RACEWAY SYSTEM

Specially designed for use as a combination surface raceway and flush-mounting fluorescent fixture support. Completely enclosed from outlet box to fixture to eliminate the clutter of external conductors, this system also protects the wiring from physical damage. It's simple "slot-up" design makes it easy to install . . . easy to wire.

SIMPLEX SYSTEM

A fluorescent fixture *support* system only, its channel is applied slot-side down, and is not intended for use as a raceway. This system combines economy of investment with maximum strength and rigidity. It is easy to install and fixtures may be attached, or relocated, without lowering, or otherwise disturbing the basic channel assembly.

Write for our product bulletin g-2. "STEEL CITY lighting supports (Kindorf channel type)."



designed by electrical engineers made by a leading electrical manufacturer for the electrical trade.

products of

STEEL CITY ELECTRIC COMPANY

PITTSBURGH 33, PA.

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PRECISION THREADED, TOUGH
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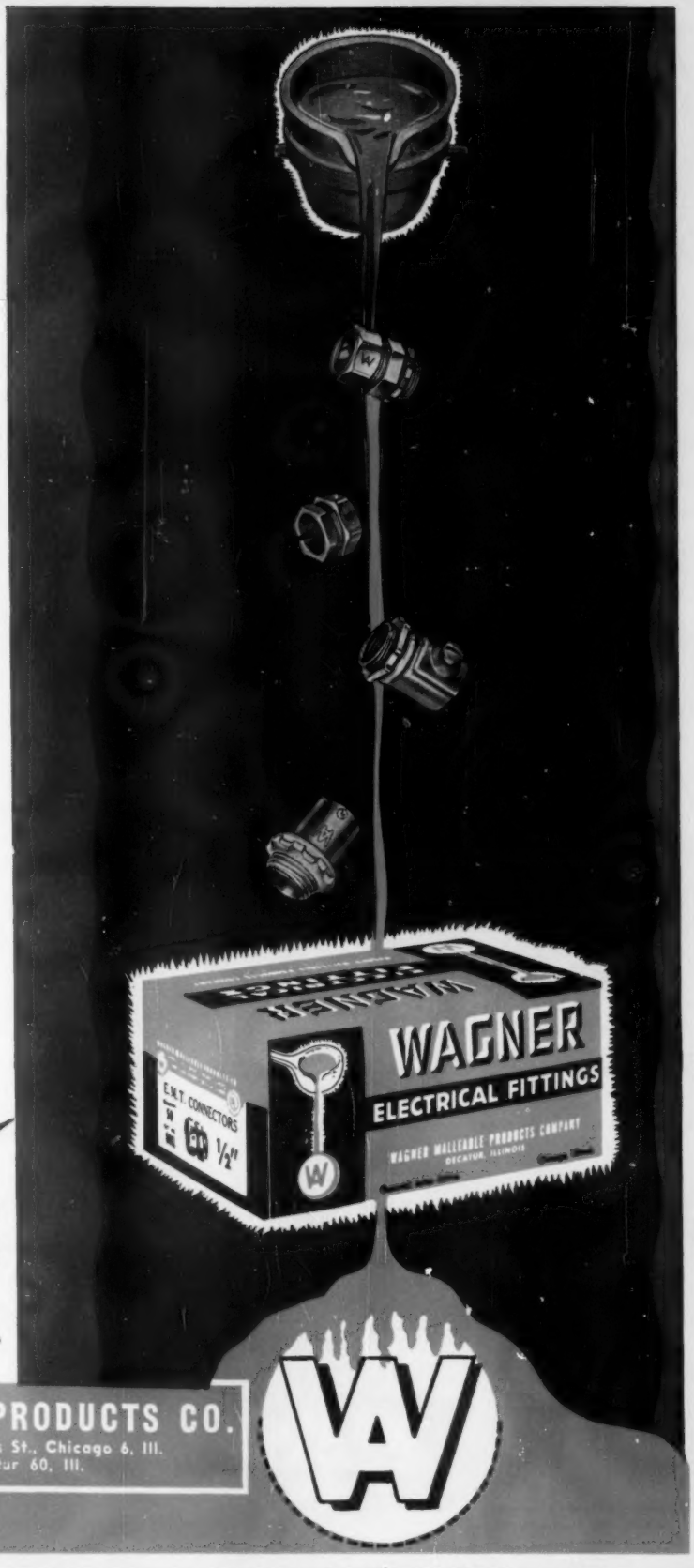
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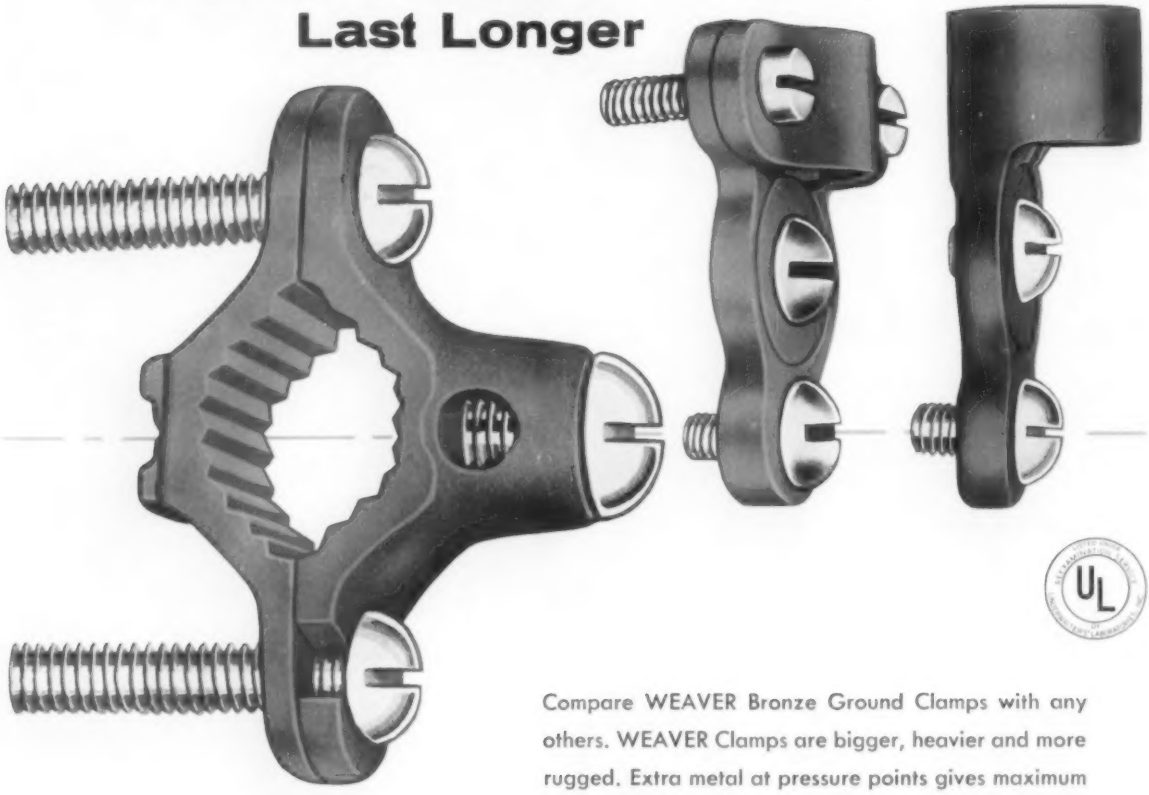
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WEAVER

BRONZE GROUND CLAMPS

. . . Easy to Install, Last Longer



The complete WEAVER line, including Bronze Ground Clamps, is IN-STOCK at your local WESCO Branch. Call WESCO for fast service!

Compare WEAVER Bronze Ground Clamps with any others. WEAVER Clamps are bigger, heavier and more rugged. Extra metal at pressure points gives maximum strength . . . increases conductivity. The all-bronze construction with heavily cadmium-plated screws prevents rust and corrosion . . . assures safe, permanent grounding. Swinging top eliminates loose parts to assemble and cuts down installation time. Only 3 types cover every grounding job. Sizes for ¼" through 4" copper or galvanized pipe.

J. A. WEAVER Company

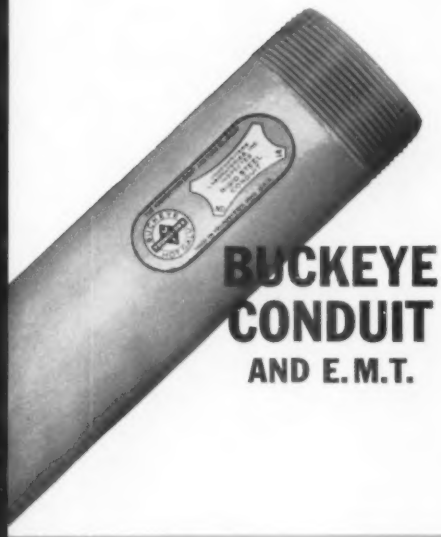
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ONE-STOP SHOPPING

Youngstown

rigid steel conduit and E.M.T.

Youngstown conduit consistently lowers installation costs because (1) it bends easily; (2) it threads easily; (3) it's easy to fish wires through. This high quality is built into Buckeye and Yoloy Conduits by using only the finest grades of steel coupled with the most modern coating techniques. This consistent top quality is closely watched from the iron ore to the finished product by one integrated steel organization, The Youngstown Sheet and Tube Company, Youngstown, Ohio. Carbon, Alloy and Yoloy Steel.



BUCKEYE CONDUIT AND E.M.T.

Hot Dipped Galvanized inside and out, including threads, plus a coating of tough, clear enamel after threading gives you *double* corrosion protection plus easy wire pulling.

Electro-Galvanized after threading with a smooth, uniform outside coating of zinc. Inside and outside are coated with tough, elastic, clear enamel, baked on, for protection and easy fishing.

Black Enameled inside and out, baked on for a tight, elastic, high-lustre finish to guard against cracking during bending and handling.

Electric Metallic Tubing. Brightly electro-galvanized with a clear elastic enamel coating baked on the inside and outside. A mirror-smooth raceway for very easy wire pulling.

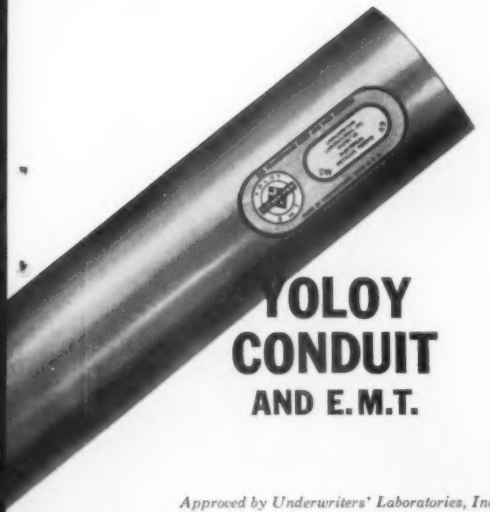
CONDUIT

Size	Nominal Diameter (Inches) Internal	External	Nominal Wall Thickness (Inches)	Threads Per Inch	Feet Per Bundle
½	.622	.840	.109	14	100
¾	.824	1.050	.113	14	50
1	1.049	1.315	.133	11½	50
1¼	1.380	1.660	.140	11½	35
1½	1.610	1.900	.145	11½	30
2	2.067	2.375	.154	11½	
2½	2.469	2.875	.203	8	
3	3.068	3.500	.216	8	
3½	3.548	4.000	.226	8	
4	4.026	4.500	.237	8	
5	5.047	5.563	.258	8	
6	6.065	6.625	.280	8	

Conduit furnished in 10-foot lengths, threaded both ends with one coupling.

COUPLINGS

Size	Outside Diameter (Inches)	Length (Inches)	Pieces Per Carton
½	1.063	1.562	100
¾	1.313	1.625	50
1	1.576	2.000	50
1¼	1.900	2.062	50
1½	2.200	2.062	50
2	2.750	2.125	25
2½	3.250	3.125	
3	4.000	3.250	
3½	4.625	3.375	
4	5.000	3.500	
5	6.296	3.750	
6	7.390	4.000	



YOLOY CONDUIT AND E.M.T.

Yoloy is unsurpassed for tough jobs where highest corrosion-resistance is needed. For example: underground installations or where conduit is exposed to salt, most chemical and corrosive industrial atmospheres.

Yoloy is a 2% nickel, 1% copper alloy steel designed especially for high corrosion-resistance, increased strength and good bending qualities. Actual tests prove coatings also last longer due to their superior adherence to Yoloy Steel.

Yoloy Conduit and fittings are available in:

Hot Dipped Galvanized
Black Enameled

Yoloy E.M.T. combines all the advantages of Buckeye E.M.T. with the high corrosion-resistance, ductility and higher strength of Yoloy Steel.

Specify Yoloy for your tough jobs.

Approved by Underwriters' Laboratories, Inc. and meets Federal Specifications

ELBOWS

Size	Radius (Inches)	Offset (Inches)	Pieces Per Carton
½	4.000	6.500	50
¾	4.500	7.250	50
1	5.750	8.750	25
1¼	7.250	10.500	20
1½	8.250	11.750	15
2	9.500	13.500	10
2½	10.500	15.000	
3	13.000	18.000	
3½	15.000	20.500	
4	16.000	22.000	
5	24.000	31.000	
6	30.000	37.500	

ELECTRICAL METALLIC TUBING

Size	Nominal Diameter (Inches) Internal	External	Nominal Wall Thickness (Inches)	Feet Per Bundle
½	.622	.706	.042	100
¾	.824	.922	.049	100
1	1.049	1.163	.057	100
1¼	1.380	1.510	.065	50
1½	1.610	1.740	.065	50
2	2.067	2.197	.065	30

E.M.T. furnished in 10-foot lengths, without couplings.

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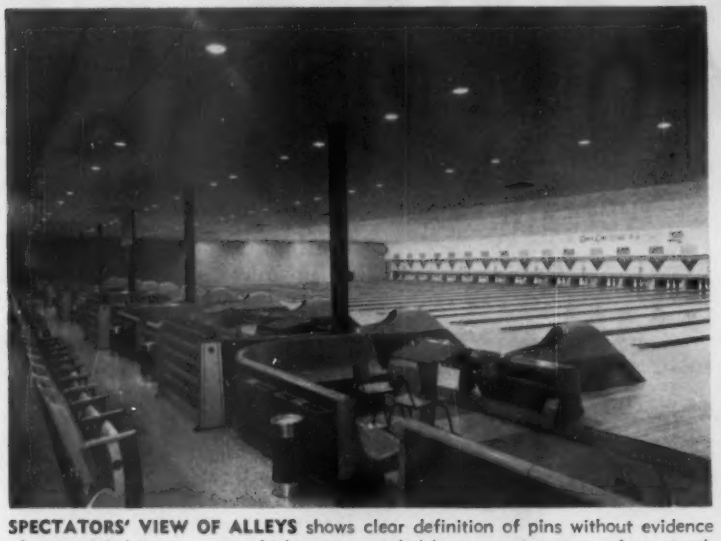
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SPECTATORS' VIEW OF ALLEYS shows clear definition of pins without evidence of general lighting sources which are concealed by successive steps of saw-tooth ceiling construction. Recessed downlights over alley approach areas, scoring tables and ball racks provide higher illumination levels over these key sections. Pins are illuminated to intensity of 75 fc.

Denver Bowling Arena Displays Lighting Variety

LIGHTING

Since bowling is ranked as one of America's top participating indoor sports, it is not surprising that excellent plans for lighting and powering crowd-attracting arenas exist in all parts of the country. Such installations are often large-load wide-variety electrical projects, for typical plans include not only liberal assortments of lighting techniques for illuminating various functional areas, but they frequently incorporate electric heating, cooling and circulation of air, automatic pin-setting equipment, related restaurants and kitchens, parking lot illumination and sign lighting as well.

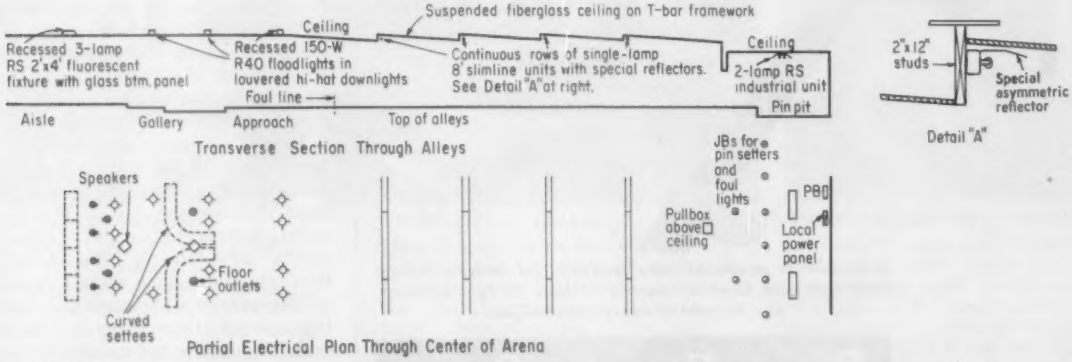
Take for example the Dahlia Lanes in Denver, where the lighting plan includes uniform general illumination for the alleys themselves; high-intensity lighting over the pins; accent light for score-keeping tables, registration counters and cashier's desks; relatively subdued illumination for spectator galleries; a good range of atmospheric treatments in an adjoining restaurant; plus several exterior signs, canopy illumination, and fluorescent mercury vapor flood-lighting for a large parking area. Many of these lighting features are automatically controlled by time switches, while additional automatic limit or thermostatic switches are installed to regulate the action of pumps, fans and heating units.

With 24 alleys in this deluxe bowling center, total power requirements call for a 1000-amp, 3-pole, 120/208-volt main breaker, four separately metered feeders to check consumption at various lighting and power distribution boards, considerable 1000- and 1350-amp 4 conductor low-reactance copper busduct, also an owner-owned transformer vault. Throughout the installation, breakers are used in relation to main feeders and branch lighting circuits, while secondary motor circuits are separately equipped with fused safety switches and either magnetic or manual starters.

In planning the lighting, elimination of glare and reflection were two prime considerations, for highly-polished surfaces included wooden lanes, adjacent terrazzo flooring, plus the extensive use of metal and plastic for furniture and accessories.

To provide uniform glareless illumination for the alleys themselves, 8-ft slimline lamps operating at 425 ma were mounted in continuous rows on 15-ft centers across the 24 alleys. Lamps were shielded from the view of bowlers and spectators by a slight saw-tooth ceiling configuration, the fixtures being mounted on successive vertical 10-in. offsets that face the pins.

Pronounced brightness variations on the inclined stepped ceiling sections are minimized through the use of custom-designed asymmetric



ELEVATION AND PLAN indicate placement of lighting units, power facilities and speakers for music and announcements. Noise level is minimized through installation of suspended fiberglass ceiling on T-bar framework. General decor, excellence of lighting and automatic pin-spotting and foul-detection equipment prompted selection of this arena for televising bowling matches. Overall, the interior characteristics are well suited to television requirements.

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In addition to powder-actuated fastening, the versatile Ramset System includes Shure-Set hammer-in tools for light fastening, and Ringblaster heavy-duty kiln gun.

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reflectors. As noted in the accompanying photograph, a slight brightness pattern is projected on side walls beneath each of the four 17-lamp rows, although this feature is generally considered to add visual interest rather than to distract attention of contestants.

Highlighting of wooden pins was accomplished by mounting industrial 2-lamp 40-watt fluorescent fixtures behind a continuous curtain wall placed slightly in front of pin settings.

In order to keep focal interest on areas of actual action, lighting for spectator galleries is on the subdued side, being provided by three rows of recessed louvered hi-hat downlights lamped with 150-watt R40 floods. Aisles behind the gallery are illuminated by a single row of recessed glass-enclosed 3-lamp 40-watt fluorescent fixtures spaced 15 ft apart except over a centrally located master "frameter" cashier counter. There the fluorescent units are mounted end-to-end in a bank of four, while four additional incandescent hi-hat units raise intensities still higher in this area.

Illumination directly on alley surfaces is in the order of 20 fc, with 75 fc provided directly on pins. This 3½-to-1 ratio is well within the range of visual comfort, while intensities are excellent for viewing and televising purposes alike.

Behind foul lines, spectator galleries have average values of 13 fc; central counter surfaces obtain 70 fc, and the flanking aisle is illuminated to a 20-fc level.

This level is twice the initially planned value. It was discovered, however, that the 10-fc level defeated its intended purpose for, rather than merely keeping aisle lighting subdued, it created an illusion of dinginess and of dirty floors. Actually, the "dirt" was found to be a myriad shadow pattern created by minute particles of dust on the highly polished terrazzo flooring, an effect that disappeared when light levels were raised sufficiently to eliminate shadows.

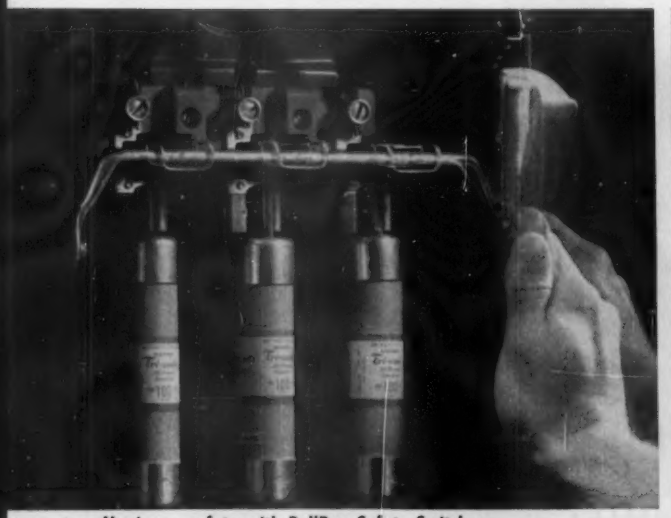
In the overall installation the appearance of the arena is artistically pleasing; noise levels are subdued through the use of fiberglass ceiling panels; music and announcements are clearly disseminated through numerous closely spaced ceiling-recessed speakers; all lighting sources above alleys or pins are shielded; ceiling hot-spots of brightness are practically non-existent, and glare from pins and alleys has been eliminated completely.

These many features, plus the

FOR SAFETY'S SAKE, BUY VACU-BREAK

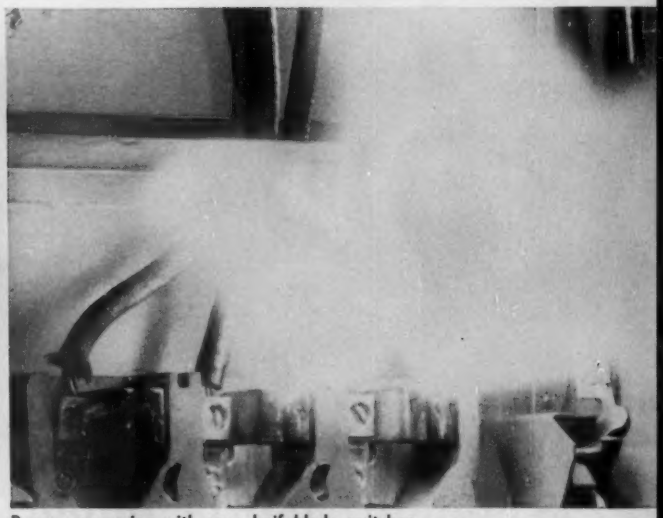
With BullDog's exclusive clamped-pressure switching contacts





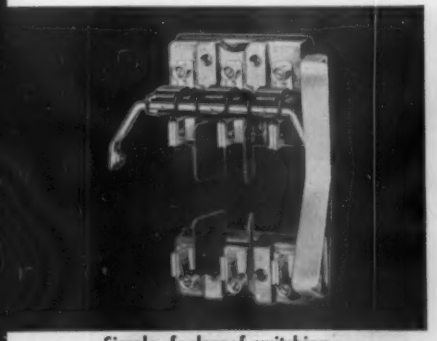
Maximum safety with BullDog Safety Switches

Arcs are smothered before they can cause fire hazard or damage to the switch because contacts are housed inside compact Vacu-Break* chambers. Pitting and burning of contacts are reduced to an absolute minimum—maintenance is virtually eliminated.



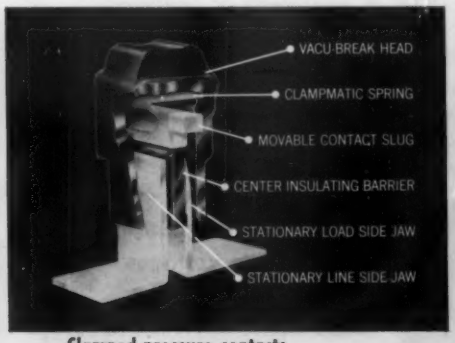
Dangerous arcing with open knifeblade switches

Unconfined flash explosion occurs, burning and pitting blades. Fire hazard and frequent maintenance are the result. These are unretouched photographs of 100 amp, 600 volt switches, operating under 90 ampere, 440 volt load with 40% to 50% power factor.



Simple, foolproof switching

Vacu-Break heads are *directly* connected to the switch handle. No toggles, triggers or springs to fail. No danger of switching failure. Positive, safe switching *every time* for a lifetime.



Clamped-pressure contacts

This close-up shows movable contact slug and Clampmatic* spring assembly inside Vacu-Break chamber. The Clampmatic assembly assures clamped-pressure contacts, speeds "break", increases switch life.



Withstand 100,000 amp fault current

BullDog Vacu-Break Switches—Master and Junior—will withstand 100,000 amp short circuit current when equipped with current-limiting Amp-Traps**. Play it safe—recommend and buy BullDog Vacu-Break!

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fact that installation details were uncomplicated, maintenance remains basic and power costs are modest, influenced the owners to construct two additional arenas.

Electrical consultant for this project was Sol Flax, while the contractor responsible for the installation was Acme Electric, both parties being located in Denver.

Ceiling Fixtures As Air Diffusers

LIGHTING

An unusual technique that disguises air diffusers within flush mounted fluorescent ceiling fixtures is employed at Graybar Electric Company's new Central District Headquarters in Melrose Park, Ill. The lighting and air diffusion system for the building's immense 28,000 sq ft general office area was installed without destroying the clean sweep of the attractive metal pan ceiling.

The fixtures that achieve air diffusion without ceiling clutter are glass-bottom units equipped with tiny side slots which transmit a vertical air flow from a low velocity air diffuser mounted above the light. The diffuser, by means of a valve mechanism, slows the speed of the air coming from a flexible tube attached to a central duct that furnishes both air conditioning and heat to the area.

Since only the glass portion of the fixtures is visible from below, the ceiling retains a completely unbroken sweep from end to end.

Due to the low velocity concept,



AIR DIFFUSION without ceiling clutter is provided in this large general office area by rows of glass-bottom fluorescent fixtures equipped with side slots which transmit vertical air flow from a low velocity air diffuser mounted above the lights.

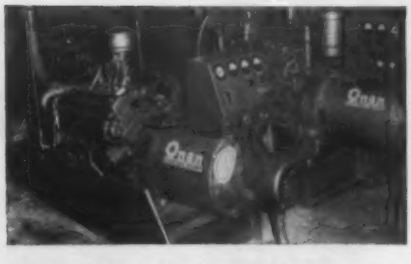


Where else in this hospital is standby power important?

Any list of critical areas or services would include elevators, heating system, respirators, aspirators, oxygen tents, communications, x-ray equipment and various kinds of pumps. Interruption of electric power to any of these could be as vital to the patient as failure of emergency or operating room lighting.

Onan can supply individual emergency electric plants up to 230,000 watts *to handle all essential hospital services.* A wide choice of voltages is available to meet the different voltage requirements of electrical equipment.

Diesel, gasoline or gas models.



Dual Onan installation supplies two voltages for essential services

Complete protection is assured this Canadian hospital with a 50KW, 115/230-volt, 1-phase Onan unit and a 35KW, 575-volt 3-phase plant.

Call the Onan distributor listed in your phone book or write for helpful literature.

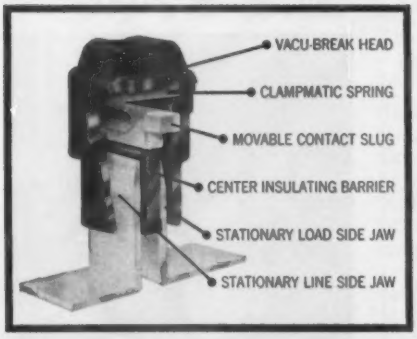
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Compact central power control—*with Vacu-Break protection*



VACU-BREAK CONTROL snuffs arcs immediately when breaking circuits under load. The enclosed head limits the oxygen available during the brief arcing period. Closeness of the head material causes the arc to cool and extinguish quickly. "Double-break" action reduces the distance the Vacu-Break head must travel before the arc is extinguished. In addition, Clampmatic action assures bolt-tight contacts, accelerates breaks.

BullDog Vacu-Break® Power Panels provide the efficient, economical way to centralize lighting and power distribution. One compact panel controls a host of lights and motors . . . saves space . . . provides real circuit flexibility.

BullDog Power Panels are prefabricated . . . switch units are quick-make, quick-break, standardized and interchangeable. Units are available from 30 to 600 amperes. It is simplicity itself to convert the panels when circuit requirements change.

Exclusive Vacu-Break control snuffs arcs quickly . . . Clampmatic® action assures bolt-tight switching connections—longer equipment life. For safety's sake—and superior performance—specify BullDog Vacu-Break Power Panels.

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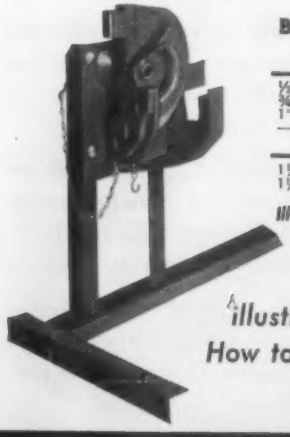
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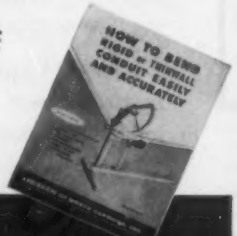


BENDING CIRCLES: INSIDE RADIUS

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½" conduit or pipe	2"	EMT 3"
¾" conduit or pipe	4¼"	EMT 4½"
1" conduit or pipe	5¾"	EMT 6½"
	No. 2	**No. 2T**
1¼" conduit or pipe	7¼"	EMT 9½"
1½" conduit or pipe	8¾"	EMT 10½"

Illustrated: No. 1 for bending ½", ¾" and 1" rigid conduit

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the noise and drafts which often accompany heating and air conditioning are no longer present. Moreover, maintenance workers are pleased with the fact that there is a marked absence of dirt streaks on the ceilings and light fixtures. The fluorescent lighting system supplies 140 fc, which more than meets their office requirements.

Molten Salt Bath Converted to Electric Heat

HEATING

The conversion of a molten salt bath from natural gas heat to electric immersion heaters has delivered a double advantage to Chain Belt Company at Springfield, Mass. By placing electric heaters in the molten salt tank, discomfort to personnel created by high heat losses of flame has been removed, and two high maintenance expenses have been eliminated. Moreover, electricity costs have worked out to be approximately the same as the previous fuel costs.

The tank, used to apply a special blue finish to roller chains, is approximately 13 ft long with an inside width of 23 in. and a salt depth of 17 in. About 3000 lbs of salt are contained by the tank. Conveyor speed is approximately 2 ft per minute.

Heat was originally applied by flame in a large brick chamber underneath the steel salt tank. Burners entered from the side and the high-temperature flame threw excessive heat, making the immediate



HEATING ELEMENTS immersed in salt bath are fed by flexible tubing from special wireway mounted on side of tank.



BIDS ALWAYS "ON THE NOSE" WITH UNIVERSAL LIGHTING DUCT

Exclusive BullDog features mean faster, easier installation that keeps costs competitive

Nothing makes it harder to figure lighting bids (particularly pipe and wire) than those unexpected—and expensive—changes you always run into after the job is started.

BullDog 20-amp Universal Lighting Duct licks that problem completely. You know in advance your final material and labor costs. So you can figure estimates—and profits—right "on the nose" before the job begins, instead of after it's over.

Changes in lighting arrangements during installation present no problem since you can tap in anywhere along the entire length of Universal Lighting Duct. Moving outlet locations, or rearranging the layout, can be done without costly and time-consuming rewiring. With BullDog, you just move the exclusive "twist-out" plug to the desired new location in a matter of seconds.

ULD is actually less expensive to install than pipe and wire, too, because it offers so many time-saving features . . . such as prefabricated parts . . . easily joined sections . . . choice of five installation methods . . . and the fact that it both feeds and supports the fixtures, thus eliminating the need for extra supports.

Join the growing list of contractors making money — and keeping customers happy — with ULD. For details, write BullDog Electric Products Co., Detroit 32, Michigan.

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vicinity of the tank in particular exceedingly uncomfortable for the operators. The conversion has made a marked difference, as all of the electric heat is utilized in the bath and the only heat losses are from the surface of the bath and some from the sides.

Two appreciable maintenance items have been eliminated. The firebrick lining of the combustion chamber no longer needs periodic renewing. This formerly represented a material and labor cost of $1000. And tanks (at $400 each) are no longer replaced due to burnouts caused by excessive flame temperatures. Both of these maintenance items occurred approximately every two years.

The electric heat is produced by 15 over-the-side, L-shaped Chromalox stainless steel sheathed heaters, 480 volts, 6 kw each, equally spaced over the length of the tank. Operating temperatures are selected according to the temperature of the work; maximum used is 700 F.

Heater operation is initiated each working day morning at 3:00 by a time clock. By 5:30 A.M. the salt bath has reached 300 F; then operation is automatically placed under the control of a thermostat which has been preset the night before to a maximum of 700 F.

Thermostatic control is in two stages. When temperature drops below preset temperature, six of the 15 heaters are energized. Drop to 21 degrees below set temperature brings on the remaining nine heaters. On temperature rise, the action is reversed. This arrangement provides more uniform temperature control and better performance with broader load distribution.

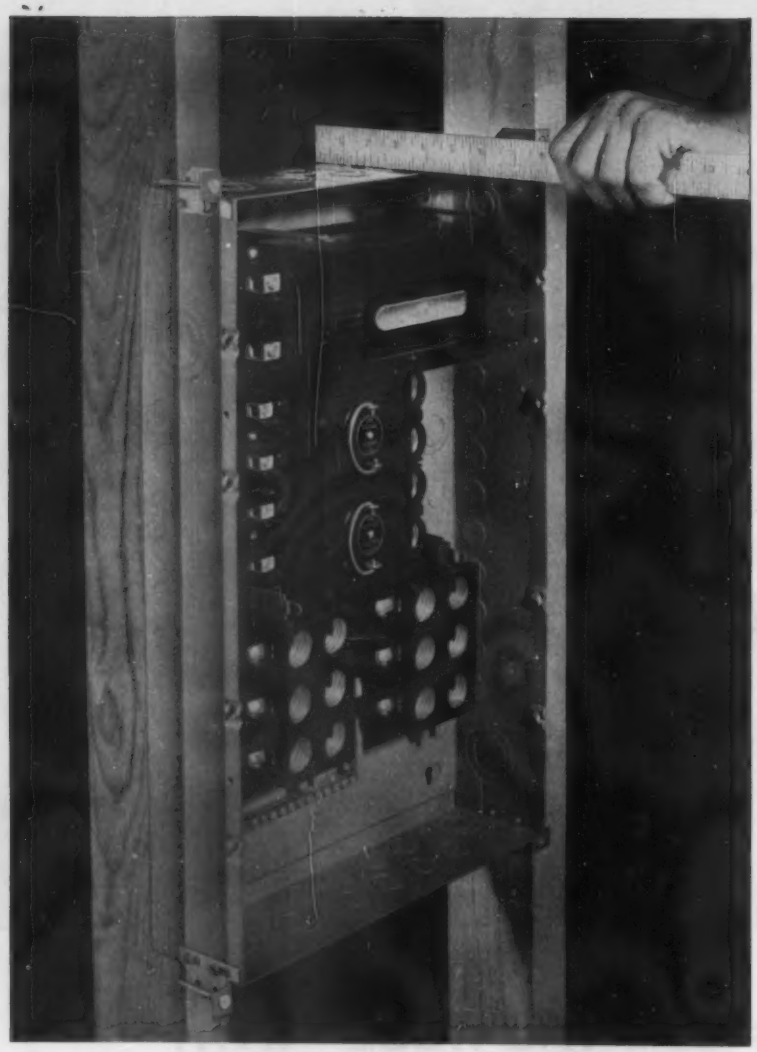
The need for better working conditions and the high maintenance costs of the gas burning system instigated the conversion.

Maximum Electrical Distribution Obtained With Cellular Flooring

WIRING

Pennsylvania's new State Office Building, located in Pittsburgh's redeveloped Gateway Center area, provides an effective illustration of how cellular flooring can be utilized to provide commercial structures with highly efficient electrical, telephone and intercommunication distribution systems.

Designed by engineer Carl J. Long and installed by electrical



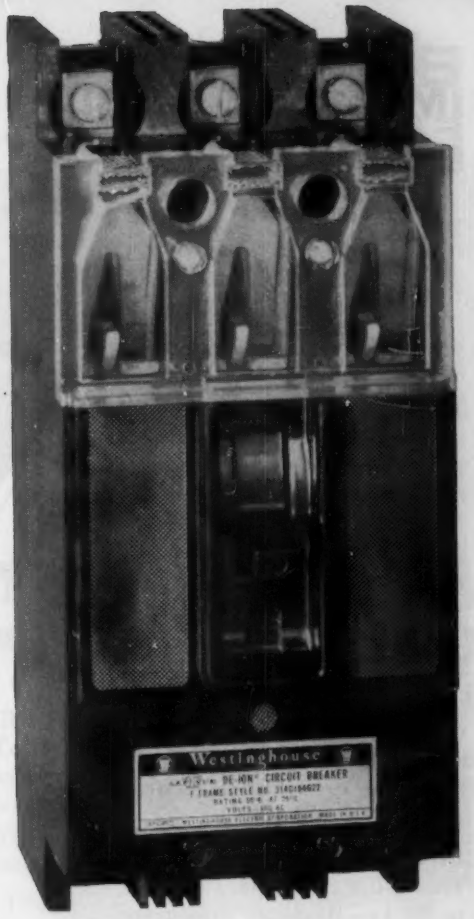
New entrance unit measures up to keep installation costs down

From its shallow 3¾" depth, removable and adjustable studding brackets, and 35% lighter weight, all the way through 15 other outstanding features, everything in the new American 100-ampere service entrance unit adds up to easier, faster installation and more dependable service—whether construction is dry-wall or lath and plaster, mounting flush or surface.

The other 15 reasons why this new American unit is your best service entrance buy? They include a neutral bar with pressure-type connectors for straight-in wiring, horsepower rated branch pullouts, tang-type plated lugs, more than adequate knockouts and wiring space, snap-on trim, interchangeable surface or flush mounting covers, non-interchangeable pullouts, and . . . But why not get the complete story first hand from your local American Electric Switch distributor who can also supply you direct from stock.

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You can see the contacts at a glance

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- Saf-T-Vue is suitable for use where plant safety codes require visible contacts.
- Saf-T-Vue is available in frame sizes E, EH, F, G, J, JK, K, JKL, KL and LM. Only from Westinghouse can you get the right breaker for every application.

For complete information on this new Westinghouse development, contact your nearby Westinghouse sales office or distributor, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. J-30308

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...for locating cable faults by impulse tracer method

...for D-C proof testing



This instrument consists of a high voltage d-c impulse transmitter with pickup coil and pointer-indicating detector. Designed primarily for locating faults on lead-covered cable installed in ducts, this equipment has applications also on aerial and buried cable, and has proved highly effective in utility and industrial service.

The transmitters require only 600 va input power at 115 v, 60 cps supply voltage and therefore can be connected to a lighting system.

MODEL 3-2 FAULT LOCATOR

Transmitter and output voltage up to 25 kv—Discharge capacitance 1.65 muf. Provided with three-range milliammeter for measuring insulation current when proof testing cable or other insulation. For use on cable up to 15 kv rating.

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Transmitter output voltage up to 15 kv—Discharge capacitance 2 muf. For use on cable up to 5 kv rating.

MODEL 5-2 FAULT LOCATOR

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B-611

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- LABORATORY & SCIENTIFIC EQUIPMENT

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DRILL HELD VERTICAL by guide bar and foot-weighted bedplate is forced downwards by spring-loaded control handle, through headerduct, into cellular steel flooring of new Pennsylvania State Office Building in Pittsburgh.

contractor E. C. Ernst, the functional underfloor wiring system (serving floors 2 through 16 inclusive) also includes headerduct sections that provide threaded outlets at floor surfaces wherever required to service power, light or communication facilities. On each floor, three runs of headerduct with JBs on 3-ft centers are installed in "corridor pattern"; junction points of individual runs being varied in order to provide for some service facility every 12 in.

In addition, a fourth parallel run is installed with junction boxes located only at key points to tie in telephone express service with the overall system serving the respective floors. This fourth run is primarily a closed duct and, unlike the three main raceways which carry wiring directly to steel cells of the underfloor raceway system, this ad-



THREE RUNS OF HEADERDUCT, 1⅜ inches deep and 6⅜ inches wide, are installed in a "corridor pattern" on each of the upper floors in the 16-office structure. Junction units are easily accessible, roomy and adjustable for exact height.



PREVENTS NUISANCE TRIPPING

AMBIENT-COMPENSATING BREAKER

No worry where extreme temperature changes exist

- Ambient compensation prevents the breaker from derating the conductors.
- Ambient compensation provides insurance against current interrupting due to false high-temperature influences.
- Ambient-compensating breakers, exclusive with Westinghouse, are available in all frame sizes. Only from Westinghouse can you get the right breaker for every application.

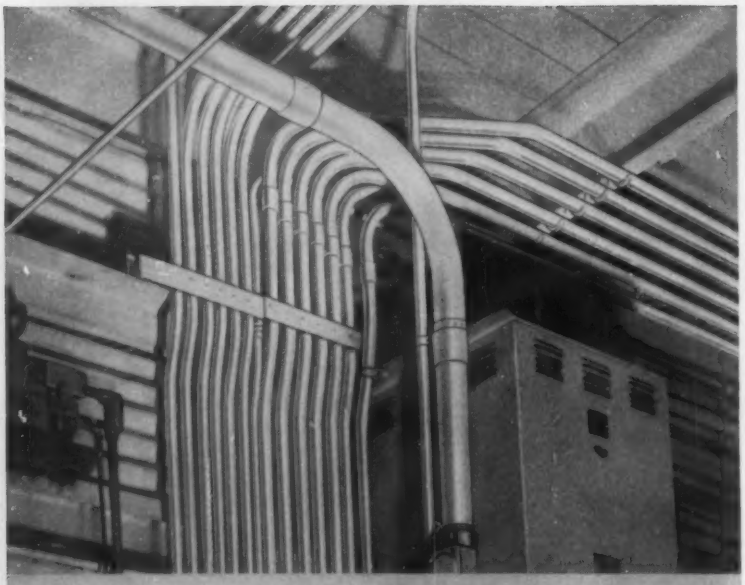
For complete information on this new Westinghouse development, contact your nearby Westinghouse sales office or distributor, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. J-30309

Westinghouse . . .
Pioneer, Developer and Leader of the Circuit Breaker Industry

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS



REYNOLDS ALUMINUM Electrical Rigid Conduit

cuts installation and maintenance costs!

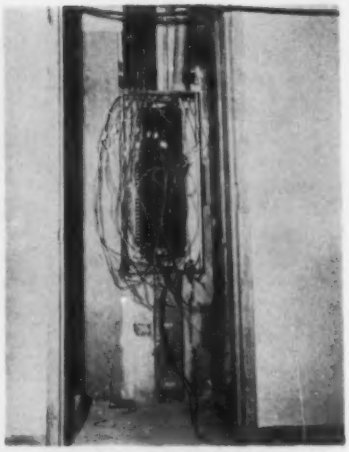
Reynolds Aluminum Electrical Rigid Conduit offers *five* important benefits: **1. LIGHTWEIGHT.** Aluminum conduit weighs approximately two-thirds less than steel conduit. Installation is faster, easier. **2. CORROSION-RESISTANT.** Aluminum cannot rust—ever—and is corrosion resistant to water, weather and most industrial atmospheres. There are no periodic protective maintenance problems, no rust on walls or surrounding fixtures. No rusting threads. **3. NON-MAGNETIC.** With aluminum conduit, voltage drop is reduced. Longer conduit runs or smaller conductors are possible. **4. EASY-WORKING.** Aluminum conduit bends and forms quickly and accurately to meet and by-pass obstacles found in many installations. **5. NON-SPARKING.** Aluminum will not spark from accidental contact with hard objects. Perfect for use in inflammable areas and atmospheres.

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

For more information and names of Reynolds Aluminum Electrical Rigid Conduit outlets, call your nearby Reynolds Sales Office or write *Reynolds Metals Company, Box 2346-ET, Richmond 18, Virginia.*

Also write for descriptive brochure.

Watch Reynolds TV shows—"ALL-STAR GOLF" and "ADVENTURES IN PARADISE"—ABC-TV



PANELBOARDS on each floor serve overhead recessed lighting system through conduit runs, and serve underfloor electrical distribution system through Wirewa sections connecting with cellular-floor headerducts.

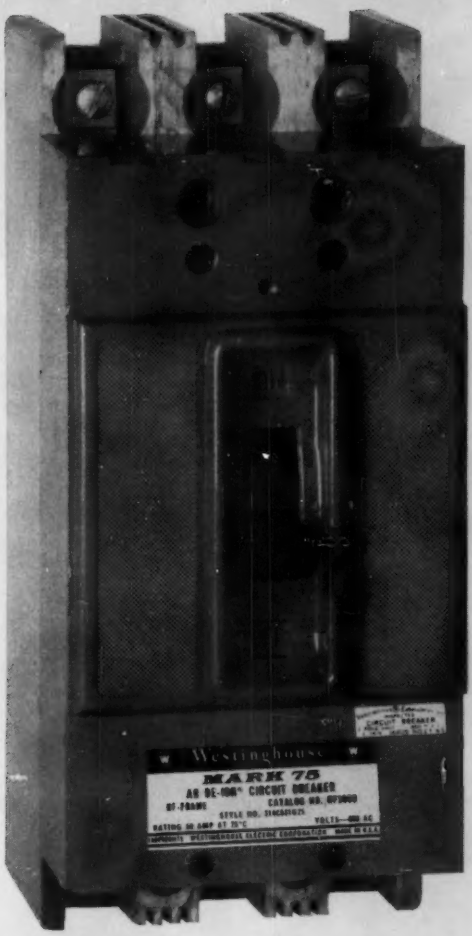
ditional duct is used to feed express system lines to the conventional telephone header. A measure of how the system is adapted to both present and future requirements is indicated by the facts that (1) every steel floor cell in the building is used for some service; (2) the express telephone raceway system bypasses conventional facilities to serve individual office areas. (3) These two features result in an efficient, unloaded distribution system, although (4) each floor is provided with a total of 273 service outlets.

To achieve flexibility and convenience on the first level of the structure, a 3-run grid of Nepcoduct is installed in the concrete subfloor and outlets with inserts finished to the floor level are spaced every 2 ft, marker escutcheons indicating underfloor duct areas and exact positions of inserts.

On the average floor, the electrical system is served by two 42-circuit panelboards, one being located on either side of the building and each roughly divided with 20 circuits for floor use and 22 circuits for lighting.

Lighting of upper floors is obtained through the installation of 256 recessed ceiling fixtures on each level, providing an average intensity of 50 fc. On the lower two levels, higher intensities are obtained from 450 fixtures.

To enclose wiring between panelboards and lighting units, some 14 miles of conduit are utilized, while additional runs are used for miscellaneous services and for risers carrying conductors to air conditioning units.



INTERRUPTS 75,000 AMPS

MARK 75 CIRCUIT BREAKER

High interrupting capacity in standard frame sizes

- Mark 75* breaker is ideal for use in network systems.
- Mark 75 breaker is UL approved.
- Mark 75 breaker is available at only a fraction of the cost of other high interrupting capacity breakers . . . and comes in the same sizes and is interchangeable with the standard line of Westinghouse AB breakers.
- Mark 75 breaker is available now in frame sizes HF, HK, HKL and HLM. Only from Westinghouse can you get the right breaker for every application.

For complete information on this new Westinghouse development, contact your nearby Westinghouse sales office or distributor, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. J-30305

*Trade-Mark

Westinghouse . . .
Pioneer, Developer and Leader of the Circuit Breaker Industry

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

Westinghouse develops new motor starters with 6 "monkey proof" safety features



Westinghouse NEMA 12 Life-Line combination starters end unauthorized tampering, offer greater safety and convenience to service personnel

To order simply contact your local Westinghouse representative or distributor now, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

YOU CAN BE SURE...IF IT'S Westinghouse

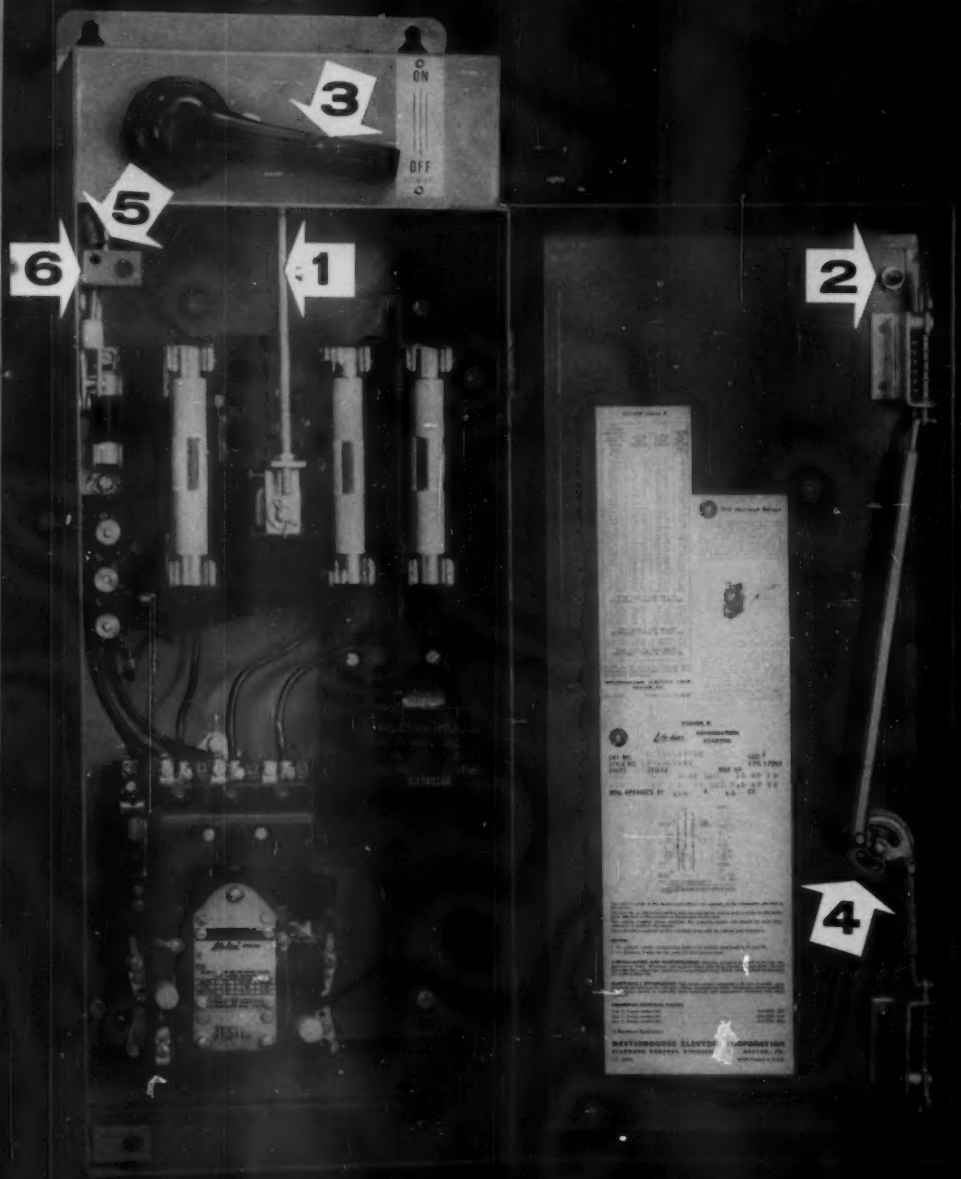
Watch "Westinghouse Lucille Ball-Desi Arnaz Shows" CBS TV Fridays

Check these 6 great new safety "firsts"... 1 2 3

SAFE—You always know whether power is on or off because ON-OFF handle is permanently attached to disconnect... even when door is open.

SAFE—Positive gasket seal keeps out oil and dust. An interlock requires that door must be tightly sealed before handle can be moved to ON position.

SAFE—Even when you're out of sight, padlocking ON-OFF handle prevents any operation of disconnect regardless of whether door is *OPEN* or *CLOSED*.



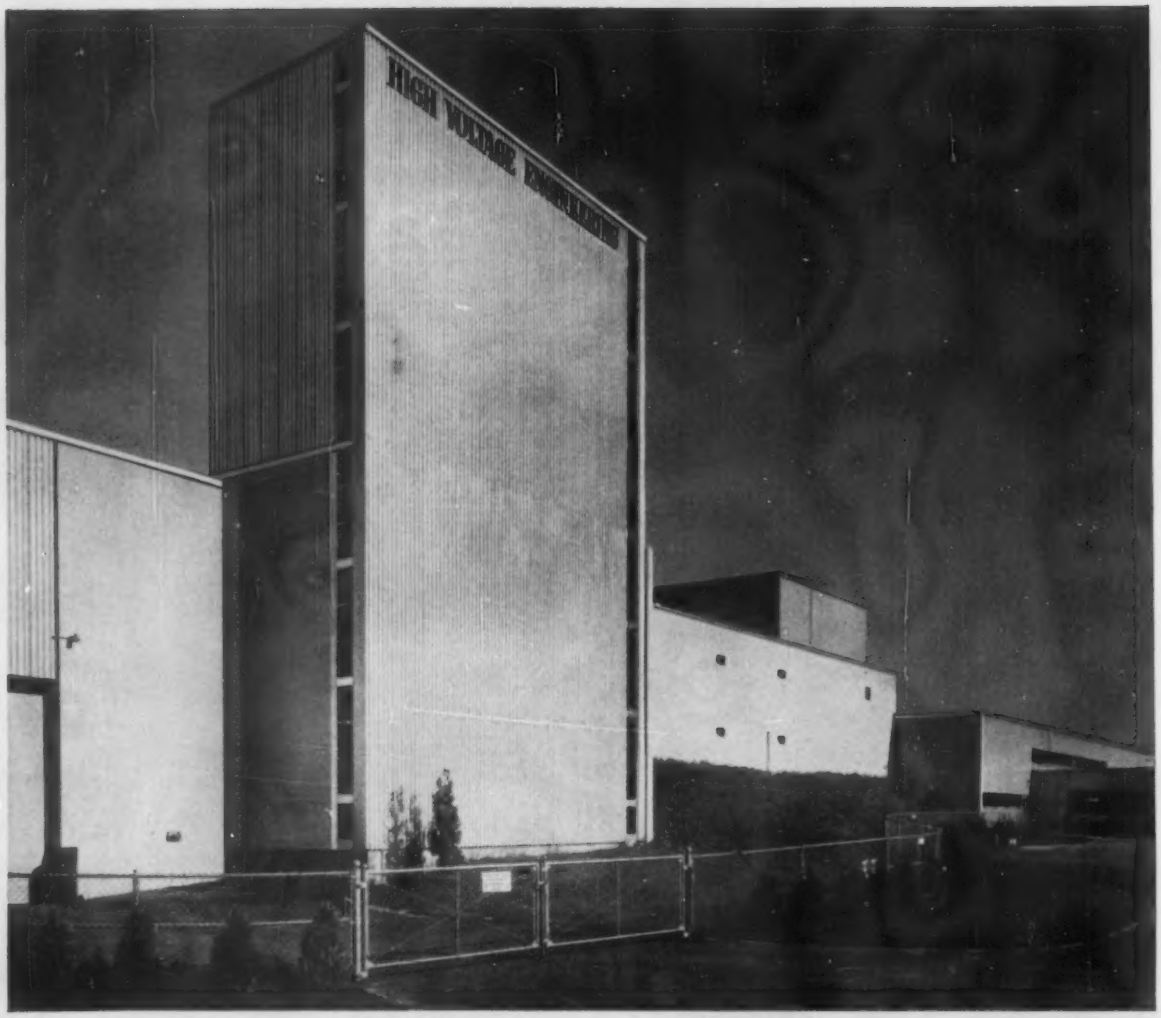
456

SAFE—Discourages tampering by unauthorized personnel. Tool required to open door.

SAFE—Accidental operation of disconnect impossible when door is open. Disconnect interlock must be deliberately voided to operate ON-OFF handle.

SAFE—Interlock prevents door from being opened when switch is on. ON-OFF handle must be in OFF position to open door.

J-30306



Partial View of the new plant on a 50-acre tract.

Architect: Carleton R. Richmond, Jr.; *Supervising engineers:* Stressenger, Adams, Maguire & Reidy; *General contractor:* Aberthaw Construction Co.; *Electrical contractor:* M. B. Foster Electric Co.

Another electrical manufacturer selected SORGEL dry-type transformers

for the operation of their plant

The HIGH VOLTAGE ENGINEERING COMPANY, in Burlington, Mass., the world's largest manufacturer of atom smashers, learned about the advantages of SORGEL dry-type transformers during an application with their product, which, on account of its nature, required the *best* transformers.

Being in a position to judge the quality of the transformers, they, like so many other electrical manufacturers, also selected SORGEL dry-type transformers for their own plant.

Complete line of dry-type transformers for every purpose

¼ Kva to 10,000 Kva — 120 to 15,000 volts

Quietest operation and high efficiency

●

Also special transformers, saturable reactors, and substations

Sales engineers in principal cities

SORGEL ELECTRIC CO., 836 West National Avenue, Milwaukee 4, Wisconsin

Over 40 years' experience in the development, manufacturing and application of transformers

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CATALOGS, BULLETINS
ADVERTISEMENTS

USE THESE CARDS

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  Use first line of boxes. Insert item numbers of products on which more information is desired.
- **CATALOGS, BULLETINS AND ENGINEERING DATA:**
  Use second line of boxes. Insert item numbers of literature desired.
- **ADVERTISEMENTS:**
  Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

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NEW PRODUCTS
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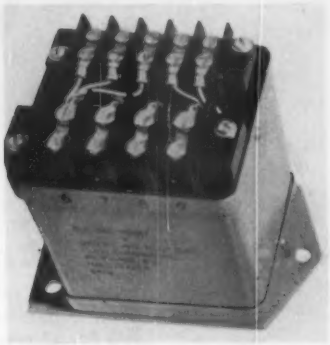
USE THESE CARDS

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Product News



Relay Device (1)

A direct monitoring overtemperature relay device has a wide range of ac applications. Unit consists of a magnetic relay, two transistor amplifiers, a diode network for signal separation and a voltage regulated power supply. Power supply ratings are 110, 208/220, 440 or 550 volts, 60 cycles. Contacts are the pilot duty type, 600 volts ac maximum.

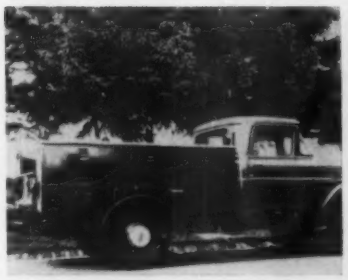
Cutler-Hammer, Inc., 228 N. 12th St., Milwaukee, Wis.



Closed Circuit TV (2)

Announcement has been made of a new line of closed-circuit TV equipment consisting of five cameras and two monitors for use in the industrial and education television field. Four models of the camera provide: 1) either automatic light compensation, or, manually controlled compensation; 2) either random interlace, or, locked interlace. Automatic models adjust by themselves for variations as much as 200:1 in light levels at the televised scene. Random interlace models assure picture stability through use of crystal controlled horizonal sweep circuits, power frequency controlled vertical sweep and sync pulses. Industrial monitor has a 14-in. screen, and a 21-in. screen is provided for the second monitor, designed especially for educational work.

Motorola Inc., Communications and Industrial Electronics Div., 4501 W. Augusta Blvd., Chicago 51, Ill.



Utility Truck Bodies (3)

Eighteen utility truck body models are designed for electrical contractors. Bodies range in sizes from ½ to 1 ton. Compartment capacity varies from 35 cu ft to 68 cu ft. Bins are provided inside watertight compartments. Other features include removable shelves and trays, and interchangeable bins.

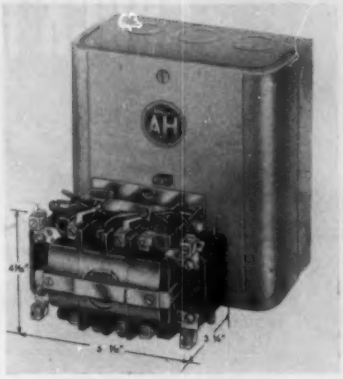
Reading Body Works, Inc., Reading, Pa.



Electric Spot Heater (4)

Resembling a fluorescent fixture, a new infra-red heater, called Solaray is designed for indoor, outdoor and industrial applications where spot heating is required. A specially developed heating element is encased in a fused quartz tube. Units operate on 110 volts and can be furnished for use on 208- and 230-volt circuits. Further information available.

Wiggin Products Co., Inc., 50 Terminal St., Boston 29, Mass.



Motor Starters (5)

New Model 58 RA series across-the-line magnetic starters and contactors are available for NEMA sizes 0 and 1, single and polyphase, with ratings up to 7½ hp at 220 volts and 10 hp at 440 and 550 volts. New features include epoxy-resin encased coils and a wide voltage range of holding coils. "RA" design pamphlet available.

Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn.



Load Center (6)

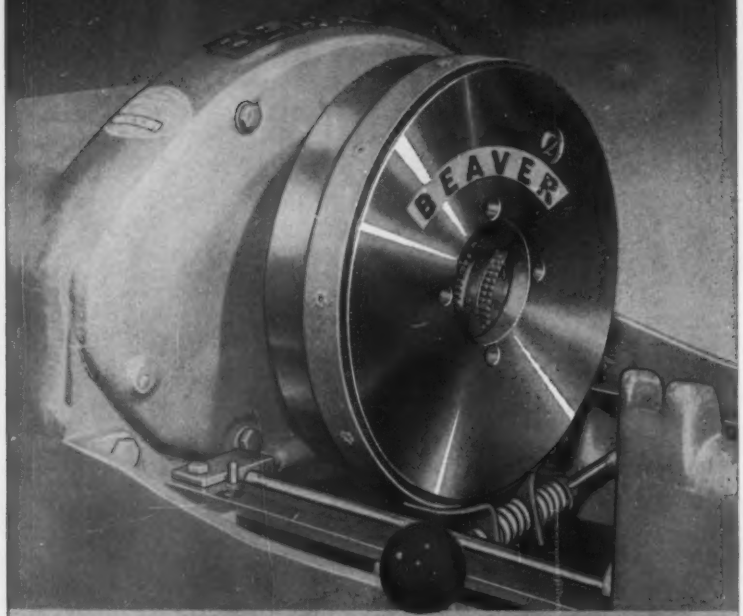
A new 100-amp main disconnect meter socket-load center accommodates up to eight single-pole or four double-pole branch circuits. Panel has lugs suitable for both copper and aluminum conductors and knockouts in the top of semi-flush enclosures to allow the installer to take out branch circuit wiring from the top of the box, as well as from the bottom, back and sides. Ratings are 120/240 volts ac, single-phase, 3-wire.

Circuit Protective Devices Dept., General Electric Co., Plainville, Conn.

CHUCK THAT PIPE

Electrimatically

FOR *SPEEDIER* PRODUCTION



The BEAVER Electrimatic Chuck grips forward or reverse the instant you flip the switch...



Available on BEAVER Speed-O-Matic or Model A Pipe and Bolt Machines

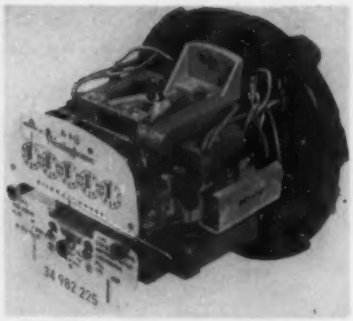
BEAVER

Send for complete catalog and name of nearest distributor

PIPE TOOLS, INC.

DANA AVE.

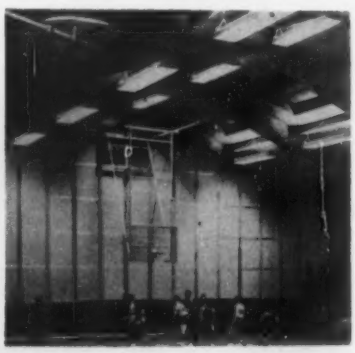
WARREN, OHIO



Watt-Hour Meters **(7)**

A new line of 120-, 240-, and 480-volt polyphase watt-hour meters includes improved design for all types previously available plus a universal meter for 120-, 240-, and 277-volt circuits. The universal meter has a dual-rating voltage coil and a series-parallel switching device; and can be used on both 120- and 240-volt circuits without recalibration. Without demand registers, meters in the line range in height from 7 1/2 in. to 8 1/2 in.

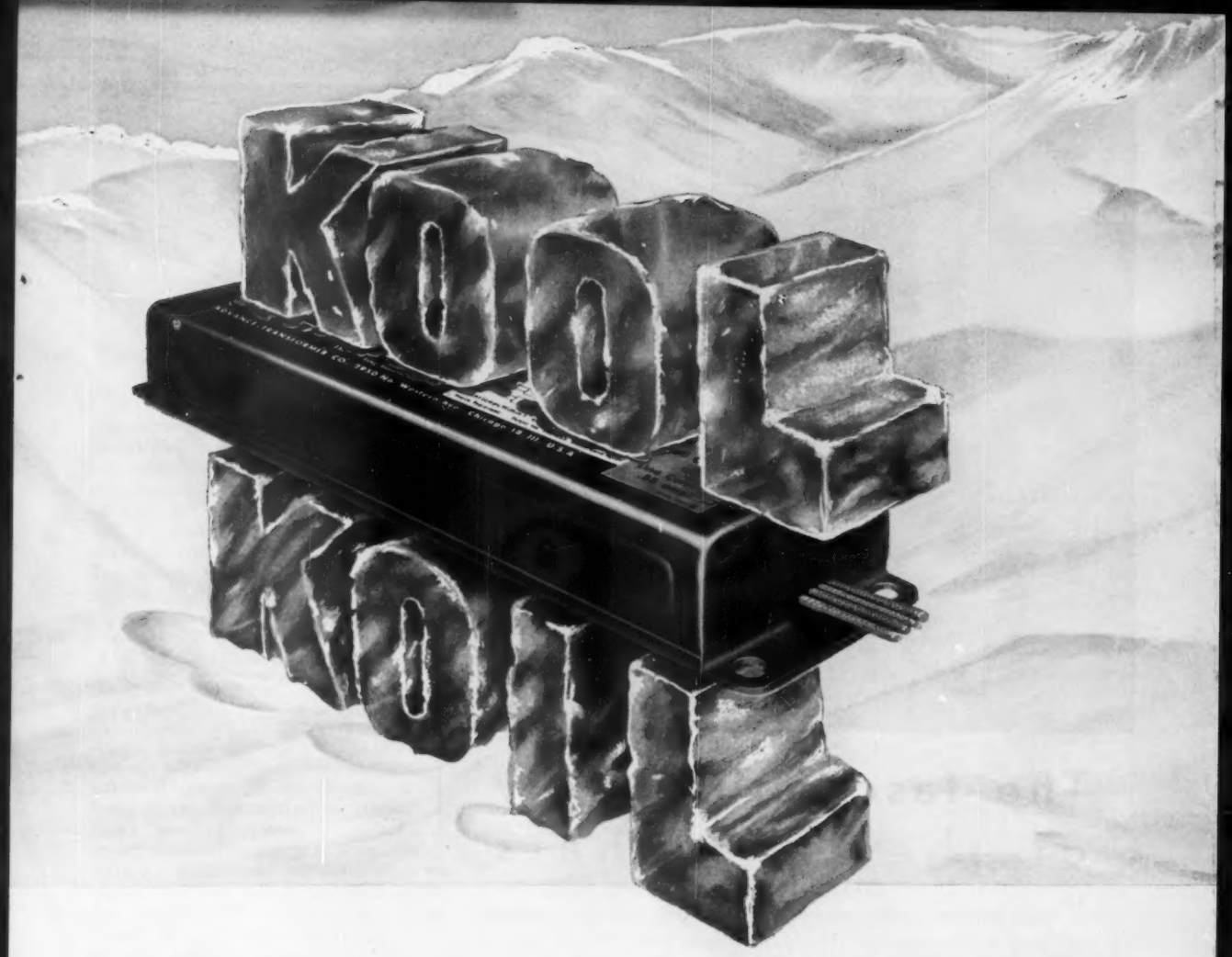
Meter Department, Westinghouse Electric Corp., Raleigh, N. C.



Gym Fixtures **(8)**

New fluorescent fixtures designed for gymnasium lighting are offered in 4 ft and 8 ft lengths for two Power Groove lamps. Construction features include a durable louver which cannot be damaged by basketballs and other equipment used in gyms. Reflectors and baffles interlock into one integral assembly formed of heavy 0.032 in. aluminum, and engineered for 38° shielding. To provide easy maintenance, two spring-release mechanism allow the complete reflector assembly to be lowered to an attached chain support position for cleaning and relamping. Ballasts may be replaced without disturbing lamps.

Paramount Industries, Inc., Flint, Mich.





LONGER BALLAST LIFE

Ballast life is cut in half for each 10°C over normal operating temperatures. ADVANCE KOOL KOIL BALLASTS operating 16.5°C to 19.5°C cooler give 3½ to 4 times longer life.

20% LESS WATTAGE LOSS

This higher efficiency of ADVANCE KOOL KOIL BALLASTS offers fluorescent lighting users savings in operating costs and manufacturers the opportunity to increase fixture efficiency.

The design of ADVANCE KOOL KOIL BALLASTS is the result of 3 years of research, a great stride in solving the heat problems of the lighting industry. Advance engineers separated vital components in the ballast case to end costly condenser trouble. They developed new grades of steel and wire, incorporated special insulating materials and compounds. The result, ADVANCE KOOL KOIL FLUORESCENT LAMP BALLASTS that end costly maintenance and interruptions in service. Insist on ADVANCE KOOL KOIL, designed and built to last for the life of your lighting installation.



"The Heart of the Lighting Industry"



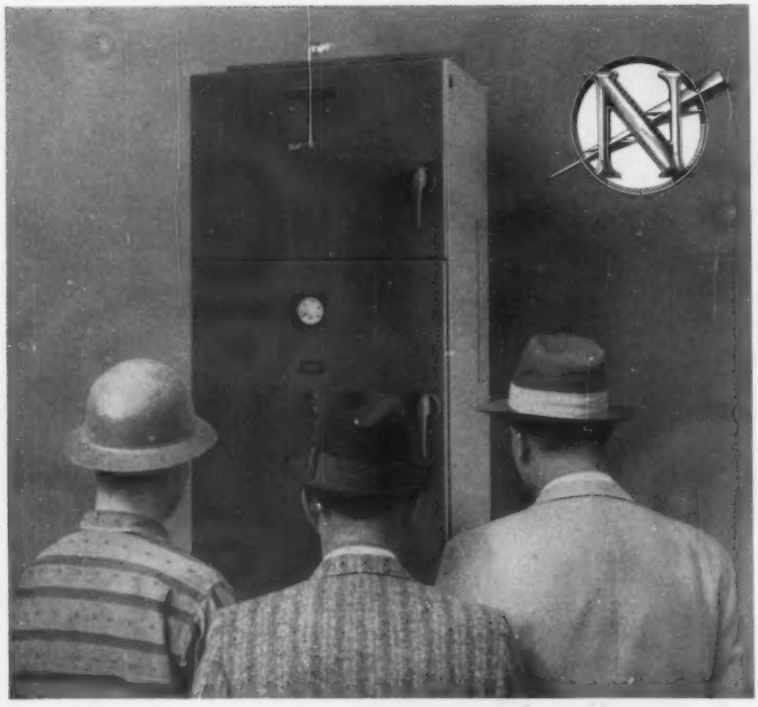
ADVANCE®

CBM CERTIFIED

World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

TRANSFORMER CO.

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.



The fascinating story of the three hats

"I'm a field man. My job includes installing and maintaining our electrical equipment. That's the reason I like Nelson. You don't have to be an M.I.T. grad to figure out how to install their stuff. Their design makes my work easier when routine maintenance is necessary."

"I'm an electrical engineer. I like Nelson, too. The equipment I specify must operate efficiently and be perfectly reliable. Trouble-free components are a must. I have no doubts when I specify Nelson."

"I'm a purchasing agent. I buy only quality equipment. Prompt action on my purchase orders is essential to me. Nelson acknowledges my orders promptly, and their production scheduling assures me of on-time delivery. Nation-wide field service leaves no doubt that they take care of their customers."

May we suggest that you, too, learn more about Nelson and their complete line of electrical control equipment for industry.

a major source of electrical control equipment for industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA



Closed Circuit TV Camera (9)

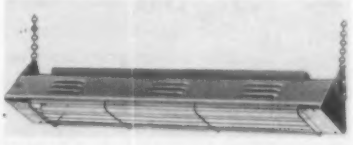
Announcement of a new closed-circuit TV camera has been made. Designed to stimulate greater demand of the medium in schools, industry and commerce, the vidicon-type camera weighs only 15 lbs. Equipped with one, two or three lenses as required, the camera will transmit an image to any standard home-type receiver.

Sylvania Electric Products Inc., 730 Third Ave., New York 17, N. Y.

Wall Switch (10)

Featuring an over-center toggle mechanism using cantilever springs to supply the force required for handle indexing and for contact closing, a new "Tap-eez" wall switch is available in brown or ivory finish with matching plates. Switches are rated 15- and 20-amp for use on 120 and 277 volts ac, and can be obtained in SP, DP, 3-way and 4-way combinations, plus a momentary contact modification. Each switch terminal will acommodate up to two-No. 10 wires.

Bryant Electric Co., Bridgeport, Conn.



Heater (11)

Instant heat is provided by a new Quartzone tube electric heater. Designed for area or spot heating, indoors or outdoors, the quartz element tube is contained in a louvered, weatherproof housing similar to a fluorescent fixture. Infrared rays emitted from the Quartzone tube may be directed to any specific area or object. Form EC-248 available.

Electromode Division of Commercial Controls Corp., Rochester 3, N. Y.

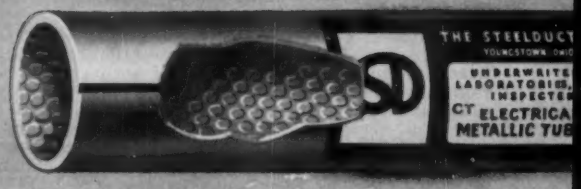
HERE'S HOW Steelduct Products SAVE TIME-CUT COSTS

RIGID CONDUIT

The sharp, clean STEELDUCT galvanized threads are the result of a process that gives the threads a measured, uniform coating of zinc—assuring free running couplings and lower installation costs. STEELDUCT plastic and fiber metal caps protect the threads against damage from rough shipping and storage conditions. Protectors are color coded for easy size identification.



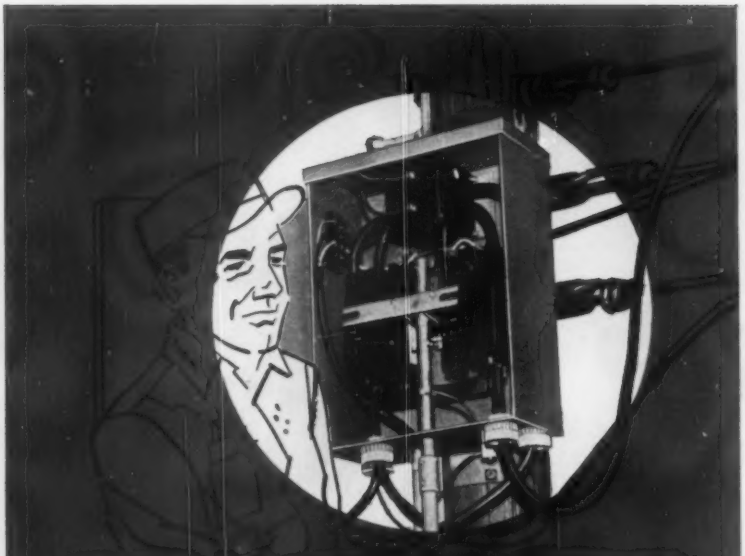
E.M.T. Knurled, silver enameled inner surface plus beadless weld reduces pulling effort up to 37%. STEELDUCT may be bent to any degree without splitting continuous welded seam. STEELDUCT Blue Bend-Aliner Stripe allows quick, accurate alignments of bends. Combined with a STEELDUCT Benfield Bender, it makes tough runs easy.



STEELDUCT PRODUCTS MEET FEDERAL and ASA SPECIFICATIONS.

THE STEELDUCT COMPANY

REPUBLIC STEEL BUILDING YOUNGSTOWN, OHIO



CUT INSTALLATION and SERVICE COSTS on rural entrances...

- *one complete package— 200 amp. service and more!*
- *no meter-loop needed!*
- *heavy duty industrial-type circuit breakers— ground level disconnect!*

pole-top metering and circuit breaker cabinets

Cut installation and service costs on entrances of 200 amps. or more—eliminate costly, power consuming meter-loops with HI-LINER! Head and shoulders above the usual pole-top metering installation, the Hi-Liner combines an overhead mounted current transformer with ground controlled line switches in rain-tight steel cabinet. Installation is fast . . . all you need is one 4-conductor #12 cable and ½" conduit running down the pole to the meter. No more heavy wire loop, weatherhead, large diameter conduit—and you'll eliminate the entire voltage drop of the meter loop! Now your customer can disconnect his entire system for emergencies or repairs—and you'll eliminate countless service calls on disconnects and local failures.

NEW! Two-way split entrance breaker—provides all the advantages of the Hi-Liner plus a split of the 200 amp. service into two 100 amp. lines. Breakers may be ground controlled either individually or simultaneously.

NEW! Underground secondary—contains a 200 amp. meter socket, 200 amp. circuit breakers with overcurrent protection, secondary wiring trough and terminal strip in one compact, pre-wired package!



WRITE TODAY — for detailed specifications on single phase, three phase, split-breaker, and other Hi-Liner units.

Choice distributor territories available, write to:

HI PRODUCTS, INC.

7740 Wentworth Ave., So., Minneapolis, Minnesota

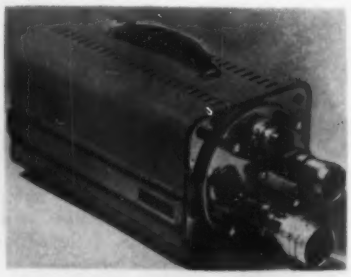
A SUBSIDIARY OF GENERAL ELECTRONIC CONTROL, INC.



Floor Insert Heater (12)

Two low-wattage floor-insert heaters are designed for homes in areas where wall heaters are not practical, such as full length picture windows, sliding doors, base of an open stair well or the inner side of exterior doors. Model FI-4, 14⅛ in. long, is rated at 400 watts, and Model FI-8, 30⅛ in. long, 800 watts. Both models are 6⅞ in. wide and 8¼ in. deep and operate on 120 or 240 volts. Heaters use a cast grid element, eliminating exposed wiring, and a thermal cutout is provided which automatically shuts off the heater in the event an object covers the heater.

Electromode Division of Commercial Controls Corp., Rochester 3, N. Y.



Closed Circuit TV Units (13)

Closed circuit TV equipment has been developed to meet the increasing need of such systems in industry and schools. Camera controls are self-contained and may be wired direct to standard TV receivers which will transmit an image on any channel from two to six. Two TV receivers, 17 and 23 in., are also offered, and they may view conventional TV programs as well as the direct-wire system. Through the use of junction boxes, an unlimited number of receivers may be connected to as many as five vidicon-type TV cameras in this system.

Argus Cameras, Division of Sylvania Electric Products Inc., New York 17, N. Y.



Pipe Threader (14)

Called "Toledo" No. 98, a new power pipe machine threads, cuts and reams all sizes of pipe through 2-in. and threads ¼-in. to 1½-in. bolts. Special features include ability to use the die head, cut off tool and reamer as close as ¾ in. from the chuck. Chuck, centering device and gear train mechanisms are interchangeable with other models made by the company. A stand, either open or enclosed, with or without wheels is optional.

Toledo Pipe Threading Machine Co., Toledo, Ohio.

Rapid Start Ballasts (15)

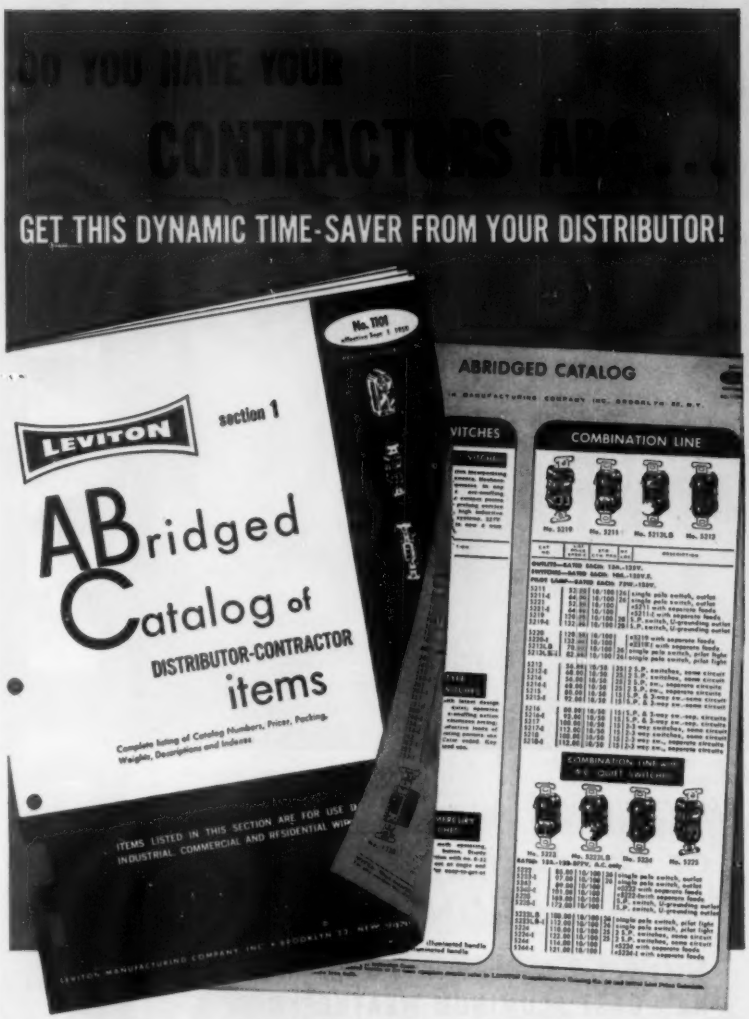
New high-output rapid-start ballasts are designed primarily for nonweatherproof use in outdoor fixtures and signs for low ambient temperatures down to −20°F. Three models are designed for use in fixtures, signs and for flashing purposes. Six additional ballasts are available to use for low ambient temperature down to 0°F. Further details available.

Universal Manufacturing Corp., 29-51 E. 6th St., Paterson, N. J.

Humidistat (16)

To meet the demand for adequate ventilation of the electrically heated home, a humidistat has been added to a line of kitchen ventilating equipment. The new KAH-180 humidistat features a 150 strand human-hair control element. A tension release device prevents the hair strands from being damaged by extreme humidity or mechanical strain. Unit is a single-pole, double-throw, line or low voltage ac or dc pilot control with snap-acting contacts to both positions. Accurate settings for controlling excess humidity are from 10% to 100% relative humidity.

Stewart Industries Inc., 320 E. St. Joseph St., Indianapolis 2, Ind.



A HANDBOOK OF QUICK AND READY REFERENCE WITH OVER 600 WIRING DEVICES USED BY ELECTRICAL CONTRACTORS.

This Leviton ABridged Catalog (ABC) lists Leviton items most in demand for power and lighting use in residential, commercial and industrial wiring!

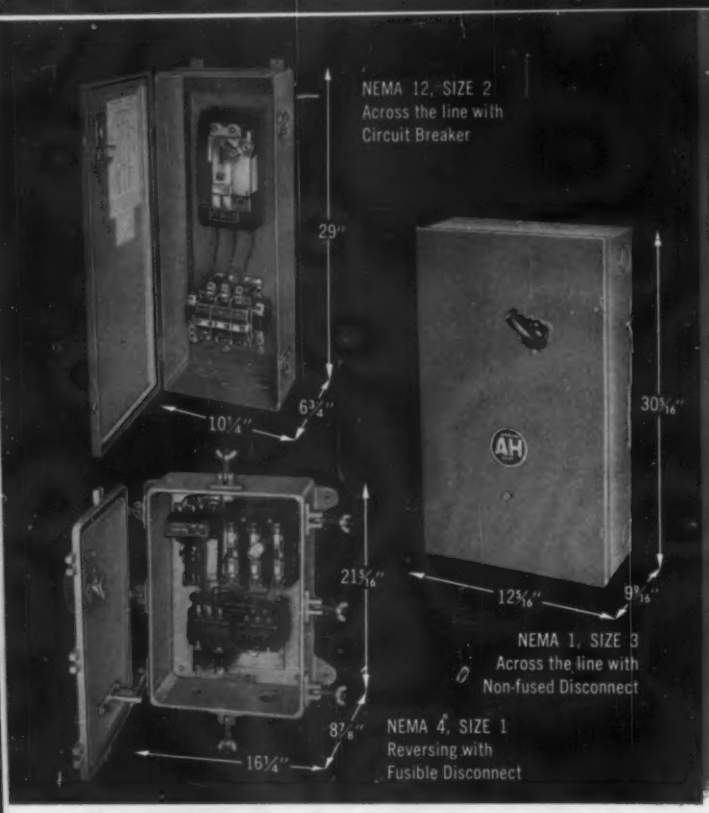
- You'll find the description and rating for each item plus the List Price and standard packaging!
- You'll find all component and mating parts grouped together by rating, by type, by grade, for easy selection of the device that will best meet the specification!
- You'll find a comprehensive numerical index that is complete, simple, neat, easy to use!
- In short, you'll find this—one of the most valuable time-saving tools ever put together for the Electrical Contractor. It was designed with you in mind, so that items are easy to find...easy to compare...easy as ABC to order...all in one step!

PROFIT NOW BY CALLING YOUR LEVITON DISTRIBUTOR FOR **YOUR COPY** OF THE LEVITON CONTRACTORS "ABC". IT'S YOURS FOR THE ASKING!

SEE US AT BOOTHS 58 & 59
NECA CONVENTION
FONTAINEBLEAU HOTEL
MIAMI BEACH, FLORIDA

Or write
LEVITON

LEVITON MANUFACTURING COMPANY • BROOKLYN 22, N. Y.
Chicago • Los Angeles • Leviton (Canada) Limited, Montreal



Announcing: **A COMPLETE LINE OF COMPACT, LIGHTWEIGHT COMBINATION STARTERS**

Sizes 0, 1, 2, and New Sizes 3 and 4—and NEW CAST ALUMINUM WEATHERPROOF and EXPLOSIONPROOF ENCLOSURES

Starters are of exclusive "Right Angle" Design which brings important installation, maintenance and performance benefits. For convenience and safety, unit is front operated by means of Fused or Unfused Disconnect, or Circuit Breaker. Circuit Breakers are Instantaneous or Thermal Magnetic Trip Types. *No other line offers enclosures that facilitate mounting and handling like the new cast aluminum NEMA 4 Weatherproof and NEMA 7 and 9 Explosionproof – Enclosures that are one-half the weight of old-style cast iron boxes.* Other available enclosures: General Purpose (NEMA 1) and Industrial (NEMA 12 – oil-tight and dust resistant).

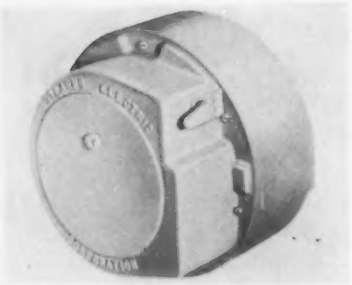
Write for new folder on A-H Combination Starters to: The Arrow-Hart & Hegeman Electric Company, Dept. ECM, 103 Hawthorn St., Hartford 6, Conn.

ARROW AH HART

Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES

ARROW AH HART



Brakes **(17)**

New 42,000 series brakes offer torque ratings of 125, 175 and 230 ft lbs, and will shortly include units up to 575 ft lbs. This series is provided with a flange suitable for mounting on the NEMA "C" flanges of motor frames 324UC through 405UC, and is shorter and lighter than comparable models presently available. Units can be obtained in both ac and dc, and in either standard, dust tight or waterproof enclosures. The new series can accept a standard shaft length or a shaft completely through the brake, should the application so demand. Literature available.

Stearns Electric Corp., 120 N. Broadway St., Milwaukee 2, Wis.



Post Top Light **(18)**

Featuring all-aluminum anodized construction, a new post top light is enclosed and gasketed to withstand outdoor elements. Unit provides symmetrical light distribution, and may be used with incandescent, medium-base lamps to 300 watts, or with mercury vapor lamps to 250 watts. Cast aluminum husk fits a 3-in. dia. pole standard.

McPhilben Lighting, Inc., 1329 Willoughby Ave., Brooklyn 37, N. Y.

Split Bus SE Panel **(19)**

New 150- and 200-amp service equipment for range, dryer, water-heater, and heating panels. The 150-amp and one of the 200-amp main lugs only devices are available in 12 and 16 plug-fuse circuits.

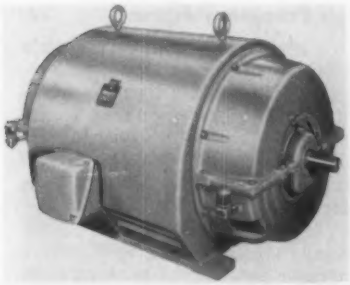
The 12-circuit has four Renu-Fuse units, one pullcover controls the lights and the other three may be used for range, waterheater, and dryer, etc. The 16-circuit has two pullcovers to control the lights and the remaining two may be used for range, waterheater, etc. The other 200-amp SE panel is available in 16 and 24 plug fuse circuits. They have six pullcovers, two pullcovers control the lights and the other four may be used for range, waterheater, dryer, heating panels, air conditioning, etc. All of the above plug fuse receptacles can be used for 240-volt heater circuits or 125-volt lighting and appliance circuits. Door trim is "Hook-on" type available in surface or flush mounting and has dead front construction. Listed by UL.

Wadsworth Electric Mfg. Co., Inc., Covington, Ky.

Batteries **(20)**

Announcement of a new line of lightweight, space-saving stationary batteries has been made. They are designed for switchgear, alarm system, telephone, control, signaling, emergency light and other uses where batteries are needed as standby emergency power. Designed for full float service, ratings are from 50 to 1140 amp hrs. Technical data available.

Gould-National Batteries, Inc., Trenton, N. J.



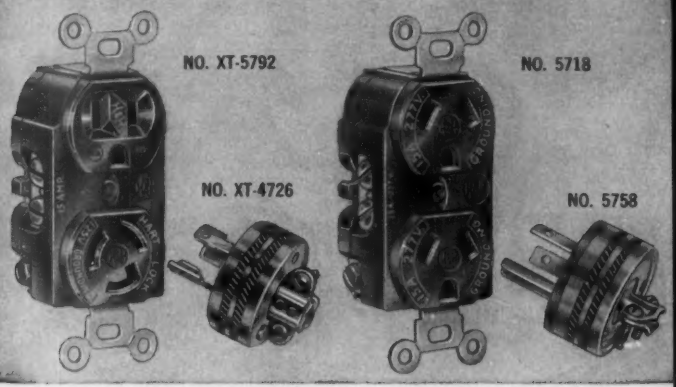
Motors **(21)**

Induction motors in open drip-proof enclosures in ratings from 150 to 2000 hp, 1800 and 3600 rpm, are a complete new line of large motors designed for industrial applications. Inspection and maintenance of the motors' capsule-type, sleeve bearing and oil rings are accomplished by removing the top half of a split-bearing bracket and split-bearing capsule. Bulletin 3350 available.

Louis Allis Co., Milwaukee, Wis.

ARROW AH HART

AGAIN! From ARROW-HART NEW SAFETY FIRSTS



COMBINATION 3-WIRE GROUNDING HART-LOCK RECEPTACLES and CAPS, 15 AMPS, 125 VOLTS.

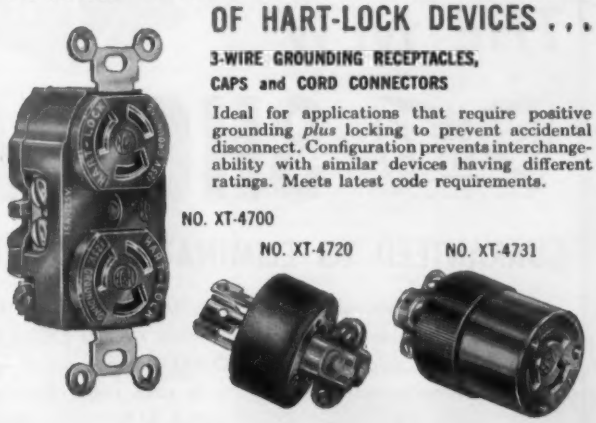
One side of this combination receptacle is 3-wire grounding Hart-Lock with 2 green hex ground screws and the other side is conventional 3-wire, 2-wire grounding 15 amps, 125 volts. Where limited space requires a duplex receptacle to provide both grounding and accidental disconnect protection and conventional U-shape grounding.

3-WIRE DUPLEX GROUNDING RECEPTACLES and CAPS—15 AMPS, 277 VOLTS.

New from A-H, this line of wiring devices is specifically designed to provide new standards of safety and dependability for industrial and commercial fluorescent lighting fixtures of the disconnecting type that operate on 227 volts.

"H & H" Specification Grade

. . . AND A NEW ADDITION TO OUR LINE OF HART-LOCK DEVICES . . .



3-WIRE GROUNDING RECEPTACLES, CAPS and CORD CONNECTORS

Ideal for applications that require positive grounding *plus* locking to prevent accidental disconnect. Configuration prevents interchangeability with similar devices having different ratings. Meets latest code requirements.

These new wiring device lines offer new opportunities to build your reputation and your business by providing electrical safety and dependability for your customers. Act now to take advantage of these opportunities. Write today for complete catalog data and ordering information.

Dept. ECM, The Arrow-Hart & Hegeman Electric Co.
103 Hawthorn St., Hartford 6, Conn.

ARROW AH HART

Quality since 1890

MOTOR CONTROLS • ENCLOSED SWITCHES
APPLIANCE SWITCHES • WIRING DEVICES

AND NOW — — —



THE NEW

EAGLE SHO-PAK®

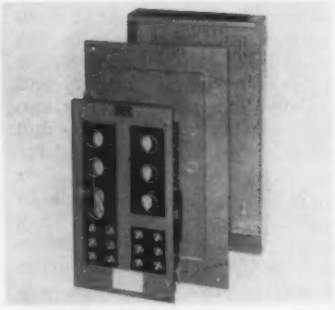
GUARANTEED TO ELIMINATE "BOX FUMBLING"

Now you can select the correct EAGLE Receptacle swiftly, save time, speed the job. Provided AT NO EXTRA COST, the new colorful EAGLE SHO-PAK® stands out anywhere, constantly keeps its contents in easy view. Eagle's well known high quality (NO DOUBLE STANDARD) eliminates callbacks. This new modern packaging (AT NO EXTRA COST) saves you more time and money.

SPECIFY EAGLE
ACCEPT NO SUBSTITUTES
SOLD THRU WHOLESALERS

Send for Free
36 page
Pocket Catalog

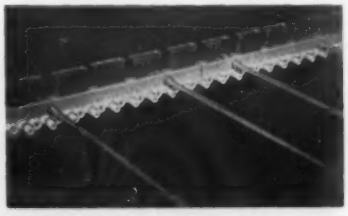
"PERFECTION IS NOT AN ACCIDENT"
EAGLE ELECTRIC MFG. CO., INC.
LONG ISLAND CITY 1, NEW YORK



Service Panels (22)

Designed to meet the needs of electric heat and air conditioning, a new line of panels are offered with fuses or circuit breakers. Uni-Pak fusible line provides up to a 200-amp main pullout or combinations up to six pullouts without a main switch. Plug fuse circuits are available from 12 to 20 poles. Uni-Pak circuit breaker line has a 200-amp fusible main disconnect, 16 pole spaces for SP or DP EQ-P circuit breakers and a 100-amp bolted-in breaker for single phase heat pumps or similar uses. Raintight enclosures are available.

Walker Electric Division, I-T-E Circuit Breaker Co., Atlanta, Ga.



High Frequency Fixtures (23)

A series of high frequency fluorescent lighting fixtures provides high intensity lighting levels for use in experimental plant growth chambers. Illumination levels from 2000 to 3000 fc are typical. Illuminated areas are used to study plant growth rate under varying environmental conditions. A specially designed 15 kva, 840 cycle generator powers the bank of high brightness lamps.

Hi-Frequency Systems, Inc., Vermilion, Ohio.

800-Cycle M-G Sets (24)

New motor-generator sets supply power for numerous 800 cycle applications, including high frequency lighting and intricate electronic control systems. Higher frequency systems permit the use of smaller electronic components such as motors, starters, filters and

chokes. The 60-cycle Synduction drive motor retains precise speed regardless of load changes on the alternator, and the 800-cycle generator is rated at 5 kva, 120/208 volts, 3-phase, 4-wire. The unit comes complete with all necessary control devices. Form 38914 is available.

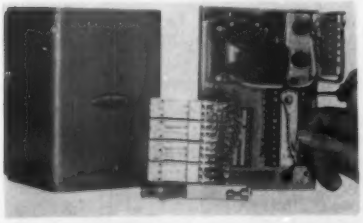
Kato Engineering Co., Mankato, Minn.



Charger Control (25)

New MP-3 charge control units provide completely automatic control of charging equipment for electric industrial truck batteries. No attendance or resetting is required, regardless of the length of the normal charge time. Unique springs-pin metal stop above control indicator makes it simple to pre-set the unit for a normal 3- or 4-hr daily finishing charge. Stop can also be lifted to move the control indicator to the 6- or 8-hr weekly equalizing-charge position.

Exide Industrial Div., Electric Storage Battery Co., Rising Sun and Adams Aves., Philadelphia 20, Pa.



Private Telephones (26)

Fully automatic dial telephone systems are now available for private use. Both desk and wall telephones are provided in black and colors. Heart of the new system is an automatic switchboard 8¾ in. wide, 11 in. high. and 6 in. deep, weighing 11 lbs. Two to ten phones may be connected to switchboard. System is designed for offices and similar businesses requiring considerable internal telephoning.

Dukane Corp., St. Charles, Ill.

WHY settle for an ordinary voltage tester?



Ask yourself these questions	The AMPROBE Junior	ordinary voltage tester
Does it measure current as well as voltage?	YES	NO
Does it give you full visibility on a graduated reading scale?	YES	NO
Does it fit conveniently in your pocket?	YES	YES
Does it measure within ±3% accuracy?	YES	NO
Does it come in a full line of models to meet different problems?	YES	NO
Does it protect you against shorts and shocks?	YES	YES
Does it balance loads, locate grounds, determine motor overloads, check rating of circuit breakers?	YES	NO

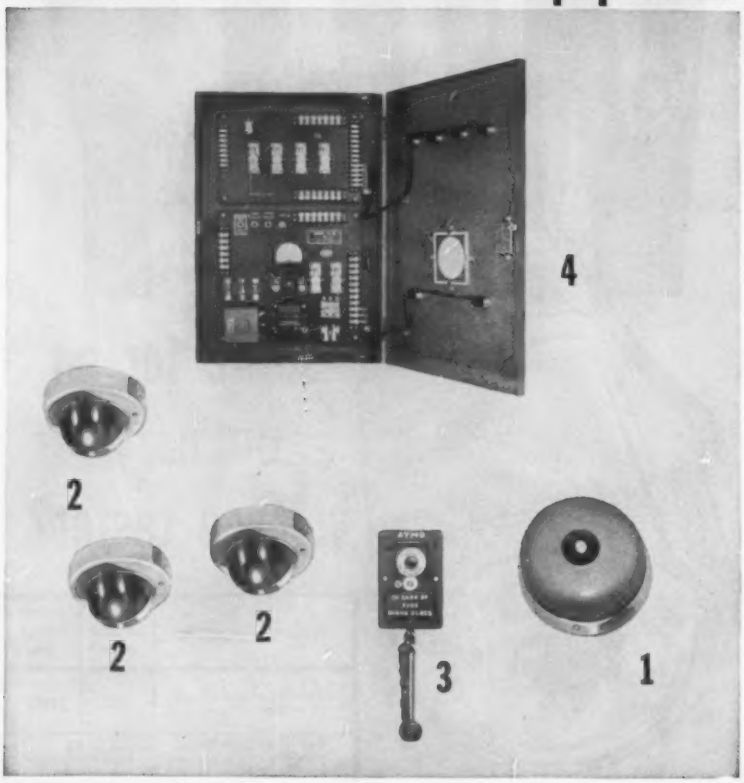
The AMPROBE Jr. gives you so much more... not just a run-of-the-mill voltage tester but a precision-made instrument that measures voltage *and* current instantly and accurately without shutting down equipment. All this with one rugged and inexpensive pocket-size tool! And now...FOR THE FIRST TIME...at the request of utilities, industrial plants and other large-scale users of AMPROBES, the AMPROBE Jr. has gone SAFETY YELLOW to conform with standard safety practices.

PICK THE AMPROBE YOU NEED! There's an Amprobe for every job, every budget: from 10 amps and 250 volts to 1200 amps and 600 volts AC; from $19.85 to $67.50. And with the Amprobe RS-3, you get a volt-amp-*ohmmeter* all in one pocket-sized, snap-around precision instrument. Every Amprobe comes with test leads; most with top grain cowhide leather case at no extra cost. See the complete Amprobe line at your jobber's today.

Amprobe Jr.
snap-around volt-amp tester
$19.85

PYRAMID INSTRUMENT CORP., Lynbrook, New York

Fire detection is big business! Cash in now with Kidde equipment!



For years, schools, public buildings, businesses and homes have been waiting for an inexpensive, dependable fire detection system approved by U.L. and F.M. Now *you* can sell them this vital detection system at a *reasonable* price. Whether you sell Kidde system components on an install-it-yourself basis, or do the actual wiring job, there are thousands of dollars in potential profits for you.

And, selling Kidde, you can be sure that you're selling quality. For more than 30 years, Kidde has been the leader in fire safety. It's a name you and your customers can trust!

Find out more about Kidde fire detection components — and how you can use them to cash in on these most profitable markets! For more information, write to Kidde today.

---

1. Kidde alarm bells — 6", 8", and 10" diameter, U.L.-approved.

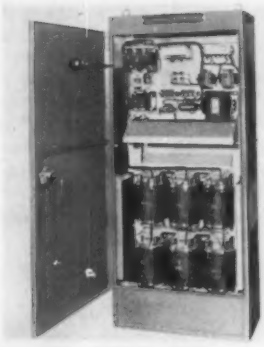
2. Kidde Fyrindex detectors. Self-resetting, fast-acting, easy to install. Fixed-temperature units each protect up to 225 sq. ft. Rate-of-temperature-rise models protect to 900 sq. ft. Combination rate-of-rise, fixed temperature units each protect 2500 square feet. All U.L. and/or F.M. approved.

3. Break glass manual alarm. One or more stations.

4. Control, rectifier, zone annunciator panels contained in one cabinet. Monitors up to ten zones. 12 or 24 v., dc.

Kidde Kidde Ultrasonic & Detection Alarms, Inc.
1185 Brighton Road, Clifton, New Jersey

A Subsidiary of Walter Kidde & Company, Inc., Belleville 9, N. J.



Voltage Drive (27)

A new adjustable voltage drive has been developed, using static power magnetic amplifiers. Fail-safe circuits are used throughout for maximum protection of personnel and machinery. Drives are available as standard packages in sizes ranging from ½ hp to 200 hp, and feature an 8/1 speed range with 5% regulation. Standard modifications include dynamic braking, reversing, jogging and dynamic slowdown. Bulletin 8834 is available.

Square D Company, 4041 *N. Richards St., Milwaukee* 12, *Wis.*



Intercom Systems (28)

New fully transistorized intercom systems feature hands-free operation and a newly developed magic eye which indicates who is calling, and automatically leaves a message. Natural voice tone from a distance up to 10 ft is received. Then the two-channel amplifier, preadjusted to the acoustical conditions of the room, makes caller's voice instantly recognizable on the other end. A handset can be added or mounted separately for privacy when others are in the room.

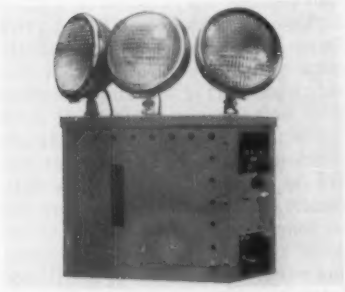
Dictograph Products Inc., Jamaica, N. Y.

Glass Lighting Panel Filter (29)

A glass lighting panel that eliminates radio interference radiated from fluorescent lamps has been developed for laboratories, hospitals and other areas where sensitive

equipment is used. Specially treated to serve as a grounding shield, the panel transmits about 75% of the open troffer illumination. Product consists of a low brightness electrically-conductive film. Coating intercepts the radiated interference which is grounded by a ¼ in. wide silver strip fired onto the film around the periphery of the glass. Additional information available.

Corning Glass Works, Corning, N. Y.



Emergency Light Unit (30)

Called "Yorklite," a new emergency lighting system turns lights on automatically in the event of power failure. Each unit will handle four 25-watt sealed-beam floodlights. When power is restored, the floodlights switch off, and the unit begins recharging. Unit, including battery, charging circuit and selenium rectifier, measures 12½ in. by 11¼ in., weighs 60 lbs, and can be mounted on walls, suspended from ceilings or placed upon the floor. Unit is listed by UL.

York Lighting, Inc., 339 W. Philadelphia St., York, Pa.

Drilling Machine (31)

Featuring a quiet, reversible vacuum unit that develops 2,000 lbs. holding power in three vacuum pads at the base of the center column, a new drilling machine cuts holes in concrete up to 4 in. per min. with diamond core bits. Braces, sand bags and pilot hole bolts are eliminated by use of the vacuum pads. Vacuum is concentrated below the central column of the machine and is of such force that the drill motor will stall before the vacuum pads will lift. A water solenoid valve is synchronized with drill motor switch so water flows only during drilling.

Diamond Core & Saw, Div. Portomag, Inc., 1521 E. Nine Mile Road, Ferndale 20, Mich.





WITH **THOMPSON**

Servisafe **POLES**



Only five minutes required to replace burn-out on 30-foot pole!

Maintaining pole-mounted luminaires really is an easy job . . . with "Servisafe" Metal Poles. All work is accomplished at ground level with a "dead" fixture. As a result, one man can relamp and clean a luminaire with complete safety in any kind of weather. And the only "auxiliary" equipment required is a detachable handline!

Decorative as well as functional, "Servisafe" Poles feature unique advantages that assure peak lighting efficiency with minimum annual cost. Both single and double-arm models of steel or aluminum construction are available in heights up to 35 feet.

FOR SPECIFICATIONS AND PRICES, WRITE FOR BULLETIN PWB-59.

THE THOMPSON ELECTRIC CO.

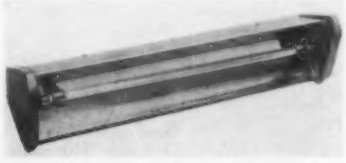
P. O. BOX 873-D, CLEVELAND 22, OHIO



Load Centers (32)

Two new "Twin" circuit breaker load centers can combine single and 3-phase branch circuits, derived from 4-wire delta systems, in the same panel. New load centers provide a unique lug and single breaker stab unit physically isolated from the main bussing. Breaker handle knockouts in the units' front rim are so arranged that only single-handle, 240-volt TQL breakers can be connected to the high leg of the delta system. Rated at 100 amps, one panel will take up to 10 SP and 5 DP breakers with a 3-pole main breaker, and the second model will accommodate up to 18 SP breakers and one 3-pole circuit.

General Electric Co., Plainview, Conn.



Aerial Heater System (33)

Add-a-Unit aerial radiant infrared heater system features an infrared element which operates in the intermediate infrared radiant wave length range of 1.7 to 3 microns with a peak of 2.2 microns. Element is provided in a reflector housing which is designed to be mounted side by side, end to end or around bends on simple angle iron frames. Special units with hollow centers for drying and curing coatings on wire, and special oven chambers are offered also. New catalog available.

N. J. Thermex Co., Inc., 533 *Bergen St., Harrison, N. J.*

Mobile Generator Unit (34)

Designed principally for servicing jet airplanes, a new mobile generator unit is now available to the construction industry where portable power is needed. Standing 48 in. high, the new self-propelled

FIVE NEW GEDNEY PRODUCTS . . .

"that fit always!"

Nobody knows better than you do how much time, trouble and expense are involved when electrical fittings don't fit properly. That's why Gedney has adopted the simplest of mottoes: *Gedney Fittings fit.* And we mean it!

Gedney Fittings are machined with unfailing accuracy, then carefully finished, finally they're scrupulously inspected. *Result?* You no longer have to make allowances for the fittings (and time) you used to throw away! One more thing. These better fittings cost you no more!

Think of all the places you can save time and money with these five new Gedney Fittings and Accessories!



GEDNEY INSULATED MALLEABLE IRON BUSHINGS (cadmium-plated). Polyethylene collar is free to turn while bushing is tightened . . . prevents binding, twisting, during installation. Sizes ½" to 6".

GEDNEY JUMPER WIRE BONDING BUSHING. Solderless lug. Malleable iron, cadmium-plated, available sizes ½" to 4".

GEDNEY INSULATED MALLEABLE IRON GROUND BUSHINGS (cadmium-plated). Solderless lug. Free-turning polyethylene collar prevents binding, twisting, of conductors. Sizes ½" to 4".

GEDNEY PUSH-PULL TAB CAP. For plugging bushings, etc. Use again and again. Strong polyethylene, in sizes ½" to 2".

GEDNEY STATIC PREVENTIVE GROUND CLAMPS. Made to ground pipe or conduit from ½" to 8".



GEDNEY FITTINGS FIT

GEDNEY
ELECTRIC COMPANY

RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.



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SINCE 1892

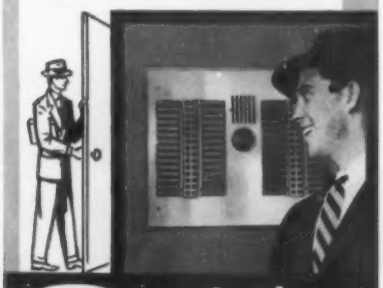
Apartment House Telephone Systems

. . . EASIEST OF ALL TO INSTALL

All AUTH apartment telephones (plug-in type) make installation and maintenance easy. Wall boxes and receptacles are shipped to the job first. The electrician can then pull his wires and connect to the receptacles at any time he chooses. After that he only has to plug each factory-wired telephone into its receptacle, fasten the faceplate, and test. Simple, economical, fast! . . . and just as easy to maintain. Artistic design, too.

VANDAL AND THEFTPROOF
Both vestibule and apartment telephones are loudspeaking . . . no receivers or cords to be damaged or stolen. Receiver-type telephones are available for houses having service attendants, as well.

WITH OR WITHOUT MAIL BOXES
The vestibule telephone is available combined with new AUTH "LIFE-size" Apartment House Mail Boxes, U. S. approved.



Auth
SINCE 1892
Auth Electric Company, Inc.

Dept. EC-11 34-20 45th St.
Long Island City 1, N. Y.

☐ Please send booklet on Apartment House Telephone Systems.

☐ I buy telephones. Have your salesman call.

Name_____

Business_____

Address_____

City_____ State_____

generator set is described as highly maneuverable and capable of traveling anywhere an ordinary vehicle can go. Generating capacities are available from 30 to 250 kva.

Stewart and Stevenson Services, Inc., 4516 Harrisburg Blvd., Houston, Texas



Fixture (35)

Introduction of a new "Satellite" series of surface and pendant lighting fixtures has been announced. Hand-blown opal glass is available in 10⅞- and 17⅛-in. diameters for recessed, surface or pendant fixtures. Larger glass accommodates two 150-watt globes, and the smaller glass, two 60-watt globes. Stems for pendant fixtures are 12 and 20 in. The opal glass is shaped in the form of man-made space vehicles from which the name "Satellite" was derived.

Prescolite Manufacturing Corp., 2229 Fourth St., Berkeley 10, Calif.

Connectors (36)

Seven types of conductor connections, including two new types, are available with 400-amp, 15-kv Loadbuster disconnect switches. Two new connectors are compatible with aluminum and copper. Three are standard NEMA connectors, and two are simple bolt-and-pad combinations that permit field choice of connectors. All seven connection options may be used with the terminal pad provided on all Loadbuster disconnects, Data available.

S&C Electric Co., 4435 Ravenswood Ave., Chicago, Ill.

Time Switch (37)

The Torkmaster time switch, formerly rated at 35 amps, both single and double pole models, are now UL approved at 40 amps. Available in the standard 24-hour dial, the units provide for setting the same ON-OFF times each day. Any number of schedules, adjustable in 15-minute intervals, may be scheduled on the one dial.

Tork Time Controls, Inc., Mount Vernon, N. Y.

Condulets (38)

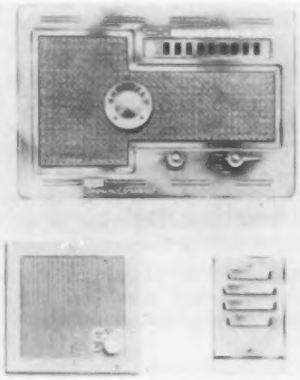
Plast-A-Coat Condulets are for corrosive locations. It has a black plastic coated, corrosion-resistant material which adheres to the Condulet surface and has good resistance to abrasion. Plast-A-Coat touch-up compound is available to cover exposed areas in threads and cover joints. By using this compound on cover joints and hub joints, the installation can be sealed against the corrosive agent.

Crouse-Hinds Company, Syracuse 1, N. Y.

Circuit Breakers (39)

New manually operated stored-energy mechanisms in three ratings of low voltage power circuit breakers have been announced. Frame sizes are designated AK-2-50, 75 and 100. Ratings are 1600, 3000 and 4000 amps respectively, up to 600 volts. Stored-energy spring-close mechanisms are said to provide positive constant, high-speed closing of contacts resulting in greater safety and prolonged contact life.

General Electric Co., Schenectady 5, N. Y.



Home Radio-Intercom Set (40)

The latest addition to the Sound Guard series of radio-intercoms is a builder's economy model No. 1050-57, "The Cadet." Conversation from room-to-room is possible, as well as music throughout the house and outdoors. It monitors the nursery, sickroom, far away rooms, and children playing outside the home. Finished with a coppertone face plate, the unit is equipped with a full fidelity AM radio, and has capacity for eight remote stations plus master station.

Progress Manufacturing Co., Inc., Castor Ave. and Tulip St., Philadelphia 34, Pa.

A New Era
in
Relay Life and Reliability



NEW

Bulletin 700, Type B-220A, AC Control Relay with 2 N.O. and 2 N.C. contacts.



NEW

Bulletin 700, Type BX-440A, AC Control Relay can be wired for normally open or normally closed contacts.

NEW ALLEN-BRADLEY BULLETIN 700 RELAYS

Improved features set new performance standards

For years, Allen-Bradley Bulletin 700 Type B and Type BX relays have been preferred for their long life and trouble free operation. The improvements in the new Bulletin 700 Type B and Type BX relays will set new performance standards wherever they are used. Naturally they use the famous A-B double break, silver alloy contacts which always remain in perfect operating condition without cleaning or filing. The cast coil cannot be damaged by the severest atmospheric conditions.

These new Allen-Bradley Bulletin 700 Type B and Type BX relays offer even greater value and greater reliability than ever before—but the price has not been changed.

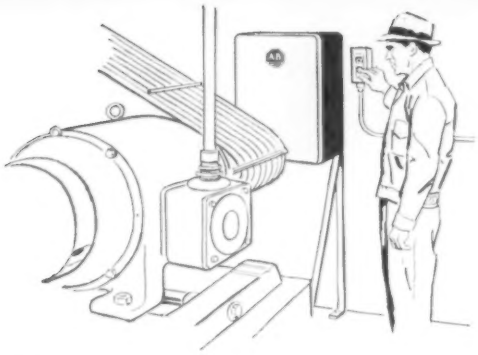
- **New mechanical design gives at least 5 times greater operating life.**
- **New contact motion provides 10 times greater electrical reliability.**
- **Complete interchangeability—mounting dimensions are unchanged.**
- **New hermetically sealed plastic coil fits Bulletin 700 relays presently in use.**
- **New, stronger, movable contact crossbar—also fits old relays.**
- **New reinforced stationary contact blocks—interchangeable with previous design.**

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

9-59-MR

ALLEN-BRADLEY
Member of NEMA

Quality Motor Control

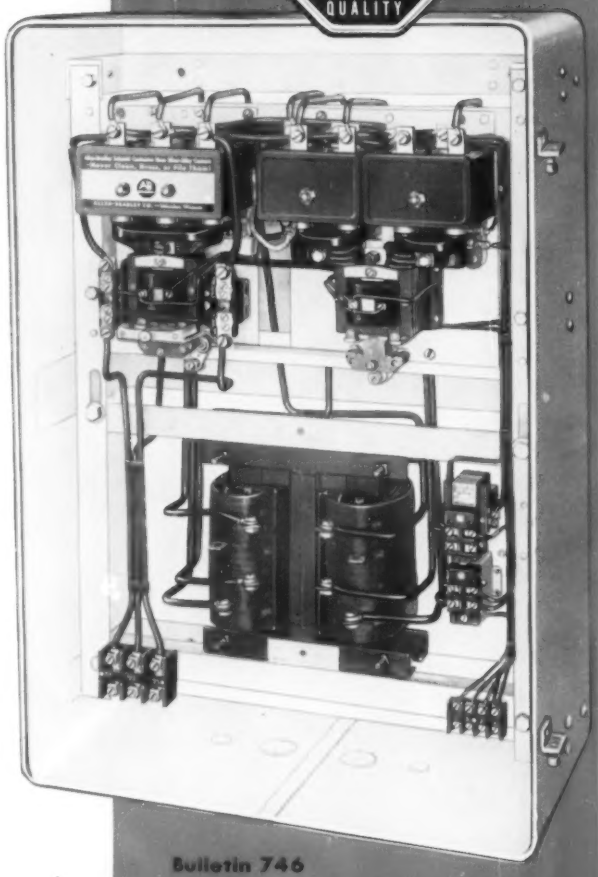


WHEN REDUCED VOLTAGE STARTING IS A MUST

Only Allen-Bradley can provide all the answers

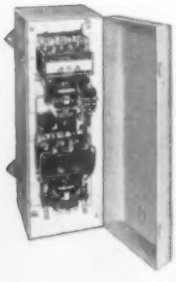
The Allen-Bradley line of reduced voltage starters makes possible a selection of the best starter, not only to meet the power company's requirements but also to provide the best starting conditions for the motor and the "load" that it drives.

The simple solenoid contactors in A-B reduced voltage starters have only ONE moving part—assuring millions of trouble free operations. And their double break, silver alloy contacts never need costly maintenance. Accurate, reliable overload relays protect motors against burnouts. Write for Publication 6088.



Bulletin 746

Automatic reduced voltage starter for squirrel cage motors that should not be started on full line voltage. It employs autotransformer connected in open delta to reduce line voltage during starting. Adjustable timing relay controls starting period. Taps are provided on the autotransformer to adjust the starting voltage applied to the motor. Ratings to 300 hp, 220 v; 600 hp, 440-550 v.

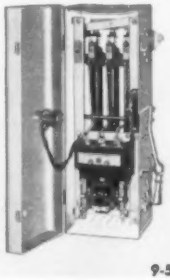


Bulletin 740

Graphite disc resistors are automatically inserted in series with the squirrel cage motor at starting, and they are automatically cut out after a predetermined time. Turning a single screw on the starter frame adjusts the compression resistors exactly to motor and load conditions for velvet smooth acceleration. Ratings to 200 hp, 220-440-550 v.

Bulletin 640

Where remote control is not needed, these graphite compression disc resistor starters provide stepless acceleration of squirrel cage motors. Operated by hand lever, the smooth starting of the motor is under the control of the operator. No-voltage and dependable overload protection is provided. Ratings to 200 hp, 220-440-550 v.



9-59-MR

ALLEN-BRADLEY

Member of NEMA

Quality Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.



Switchboard Meter Center (41)

New switchboard units include main disconnect, meter bases and distribution disconnects. Sections may be interchanged at job site to meet changing job conditions. Disconnects are furnished in circuit breaker or fusible types. All bussing from the line side of the main disconnect to the load side of the distribution disconnects is included, eliminating interior wiring in the field. Individual unitized free standing sections reduce mounting and wiring details, and provide meter space on back and front of unit.

Walker Electric Co., 125 Bennett St. N.W., Atlanta, Ga.

Fluorescent Tubes (42)

New Power Groove fluorescent tubes have been developed in deluxe cool-white color to combine greater light-producing ability with improved color rendition at higher lighting levels. Newly developed phosphors made possible the deluxe cool white Power Groove. Other lamps made by the manufacturer will incorporate the new phosphors in the future.

General Electric Co., Nela Park, Cleveland 12, Ohio

Relay (43)

New 25-amp, mechanically held, ac relays are available up to 24 poles. This increased number of poles permits wider use of these relays as primary relay devices controlling contactors, solenoid valves and similar equipment. May also be used as branch circuit devices directly controlling electric ovens and furnaces, lights and other loads within their capacity. Bulletin 1255-166 available.

Automatic Switch Co., Florham Park, N. J.

You get more for your time switch dollar through

SANGAMO HIGH RELIABILITY

here's why...



You Get Longer Operating Life
Simple, heavy duty component parts in all Sangamo time switches are precision matched for longer life. Wear and friction are negligible.

You Reduce Costly Service Calls
Extra high motor torque and conservative contact ratings plus extended time runs and high voltage breakdown tests are your assurance that changeouts and maintenance are practically eliminated.

You Can Install in Any Climate
All-weather operation is assured by corrosion-resistant materials, dustproof construction, and a high torque, slow speed motor, lubricated for temperatures as low as −50°F and as high as +200°F.

Features for All Applications
Some of the important features available in Sangamo time switches are: no time interruptions due to power outages . . . contact operation to coincide with sun time . . . control of two separate circuits in a single switch . . . optional weekly and daily schedules . . . overcurrent protection with circuit breakers . . . and a complete line of enclosures for every application.

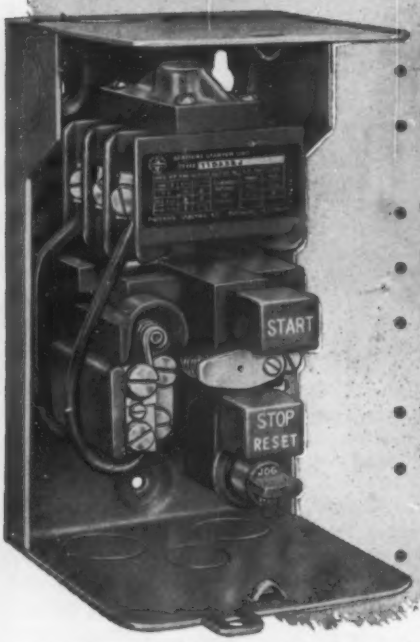
Send for your new catalog NOW...

Every time switch is described in detail on individual product sheets for a ready reference to specifications, enclosure information, available optional features and prices. All sheets are enclosed in the handy file folder shown here. Send for your free copy today!



SANGAMO ELECTRIC Company
SPRINGFIELD, ILLINOIS
ST59-2

NEW
FURNAS ELECTRIC MANUAL STARTER



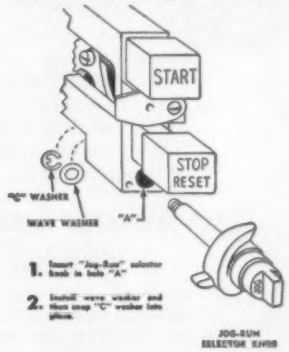
- 2-3-4 Poles
- Sizes 0 and 1; 7½ HP, AC—2 HP, DC
- Compact & Simplified
- Visible Contacts
- Pressure Terminals for Quick Wiring
- Positive Snap Action
- Trip-Free Thermal Overload Protection
- Modern Enclosures for Easy Installation

√**SUPERIOR ELECTRO-MECHANICAL LIFE**—Only two moving parts—floating toggle and spring replace complex linkages. Unitized frame and arc box, silver-cadmium oxide contacts.

√**DIRECT-ACTING THERMAL OVERLOADS**—Trip-free melting alloy type assures reliable motor protection, opens contacts independent of toggle. Second overload unit snaps into place on single phase starters.

√**"JOG-RUN" SERVICE ACCESSORY**—The first manual starter with a "Jog-Run" accessory for fast, easy positioning.

"JOG-RUN" ACCESSORY



WRITE TODAY FOR BULLETIN 11-BL

1067 McKEE ST., BATAVIA, ILLINOIS

A58

FURNAS

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES



Telephone Outlet **(44)**

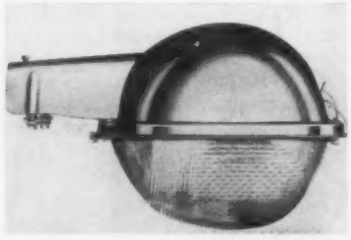
A new six-block telephone outlet with buzzer mount for use with underfloor wiring systems is available. Designed for extra wiring space the outlet will accommodate large communication cables, which will fit into the 3-in. by 9½-in. by 4⅝-in. unit. L-shaped mounting brackets hold up to 10 WE44-A telephone blocks. Outlet housing is made of aluminum. Bottom plate of the outlet has tapped holes for a 7E buzzer, and for cable clamps. Knockouts are provided.

General Electric Co., Bridgeport, Conn.

Box Support **(45)**

Designed to reduce labor costs, a new bracket provides rigid mounting for boxes and conduit on metal door bucks before masonry walls are installed. Bracing and tying down boxes is eliminated. Mounting arm bends to flush outlet box with any wall thickness.

Larco Mfg. Co., P. O. Box 169, *Wheaton* 5, *Ill.*



Luminaire **(46)**

A new lightweight mercury luminaire, designated Line 2A1, is designed for streets, highways and other high-level lighting areas. It is equipped with a fixed mogul socket for multiple service and accommodates lamps rated at 250, 400 or 425 watts. Heavy gauge aluminum housing also serves as a reflector. Aluminum slipfitter casting for 1¼-in. or 2-in. pipe is adjustable from horizontal to 10° above horizontal. Literature is available.

Line Material Industries, McGraw-Edison Co., Milwaukee 1, *Wis.*



Ingenious wire stripper on G-E outlet removes insulation fast. Mounting screw acts as handy strip gage.

Look...a built-in wire stripper at no extra cost!

Call your General Electric distributor today!

For your convenience, several General Electric specification grade wiring devices now come with a clever Automatic Wire Stripper* built right into the mounting strap. See how easily it works . . .

You just push the stripper opening onto a wire until the wire is even with the end of the mounting screw. Then pull back on the device. A piece of spring steel behind the opening strips the insulation off to just the right length — fast and clean!

You get the Automatic Wire Stripper at no extra cost on GE5411, GE5413, GE5481 and GE5483 a-c Switches; and on GE4029 Double Outlets.

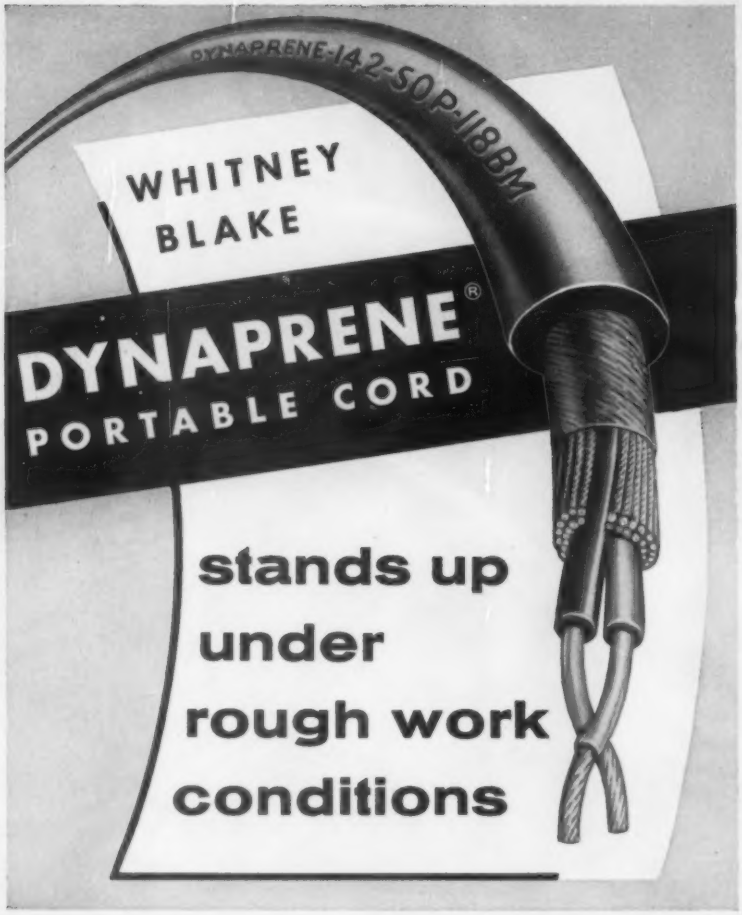
This is just *one* of many reasons why General Electric wiring devices are more convenient to use. Ask your G-E distributor to tell you more about the complete line that's designed with the contractor in mind! General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

**Patent Pending.*

Progress Is Our Most Important Product

GENERAL ELECTRIC





Where portable cord takes a beating because of rugged work conditions, WHITNEY BLAKE DYNAPRENE stands up and gives long, economical service.

DYNAPRENE has an especially tough neoprene jacket, it resists abrasion, has high flexibility and long flex life, and provides premium quality service at competitive prices.



Write TODAY for this complete catalog . . . FREE.

WB

WELL BUILT WIRES SINCE 1899

WHITNEY BLAKE COMPANY

NEW HAVEN 14, CONNECTICUT



Transformers **(47)**

New line of epoxy compound filled dry-type distribution transformers are built in single-phase ratings 1 through 10 kva, 600 volts and below. Wound-core Form W element is placed in its steel enclosure and completely covered with liquid epoxy resin to which filler and catalyst have been added. As the resin cures, it hardens into a block of insulating material solidly encasing core and coil assembly and protecting it from dust, moisture and corrosive fumes. They can be mounted in any position, on wall, floor or ceiling.

Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo.

Product Briefs

(48) A new line of yellow **rubber caps** and **connectors** made of DuPont neoprene has been announced by the Arrow-Hart & Hegeman Electric Company, Hartford, Conn. . . . . (49) T. B. Wood's Sons Co., Chambersburg, Pa., has announced that the new "SVS" is a multiple-groove **variable-speed sheave** for use with standard V-belts.

(50) The Winslow Company, Union, N. J., has announced a completely modernized version of the hand-crank, **Series B Megohmmeter** . . . . (51) A new line of decorator-styled electric **door chimes,** known as Intermatic Hi-Fidelity door chimes, has been introduced by International Register Co. Chicago 6, Ill. . . . . (52) The new Ridgid No. 453 **spiral reamer** smooths the inside edges of 3½- to 4-in. pipe. It is manufactured by the Ridge Tool Company, Elyria, Ohio.

(53) An especially formulated **neoprene compound** in handy tape



G-E RMS-3A unit controls twenty-five remote 120V, 240V, or 277V circuits through inexpensive relay circuits of lightweight wire.

Low-cost motor-master control saves expensive switch loops in commercial lighting circuits

Call your General Electric distributor today!

Here's the most practical unit you can offer, for master control of lobby, elevator, stairway, foyer, exit and emergency lighting: The new General Electric RMS-3A Motor-Master Control.

It's a motorized master switch, that turns 25 remote circuits ON and OFF, quickly, from one or more locations. Building superintendents or other personnel just push one button that actuates the control, to turn all the circuits ON or OFF.

You save money installing the RMS-3A, because it eliminates long, high-voltage switch loops between distant circuits and master-control locations. 24-volt G-E Remote-Control switching circuits and relays are used, instead — so that all connections to the control can be made with inexpensive, lightweight wire.

See your General Electric distributor for new wiring devices that give you the edge over competition! General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

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GENERAL ELECTRIC



NOW! TWO MODELS FOR NEW VERSATILITY

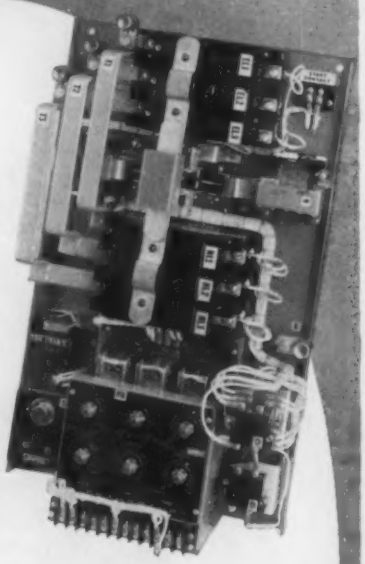
TRANS-O-MATIC* dual circuit breaker TRANSFER SWITCHES

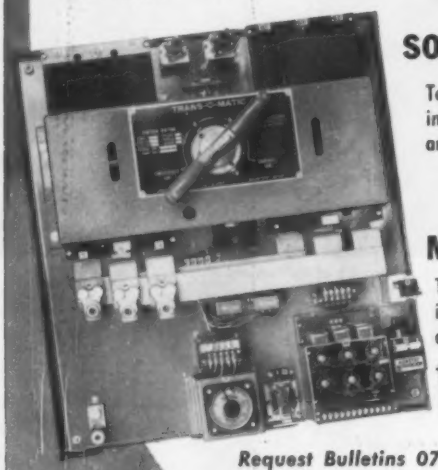
NO NEUTRAL POSITION

DOUBLE SOURCE CONTROL

For higher current interrupting capacities, rely on the motor-operated Trans-O-Matic. For low current service, employ the new low-cost solenoid-operated T-100-A. Both are electrically operated . . . mechanically held, with no neutral position. Both feature Lake Shore's exclusive mechanically-linked dual circuit breaker design for *positive* two-position transfer.

Available in 2-pole, 3-pole total failure, partial failure, and under voltage protection, with many optional features.





SOLENOID OPERATED

To 600 volts, 100 amps AC with interrupting capacities to 15,000 amp rms.

MOTOR OPERATED

To 600 volts, 800 amps AC with interrupting capacities to 100,000 amp rms.†

† With current limiting fuses.

Request Bulletins 07400-07500

*CANADIAN WESTINGHOUSE, LTD., is licensed to manufacture Trans-O-Matics in Canada.

THE Lake Shore ELECTRIC CORPORATION

205 Willis Street BEDFORD, OHIO

form, called "Neofoil," has been developed by Bishop Manufacturing Corp., Cedar Grove, N. J. . . . . (54) A new 3-way **light bulb** made in an exclusive new cylindrical shape, has been announced by the Westinghouse Lamp Division, Bloomfield, N. J. . . . . (55) A weatherproof **electronic unit** called "Nytrol," manufactured by Micro Balancing, Inc., Garden City Park, N. Y., converts lawn post lights to fully automatic On-Off operation.

(56) Auburn Machine Works, Inc., Auburn, Neb., has introduced a new **trenching tool,** called the TrenchSaw, which is designed to cut a narrow trench of approximately 1-in. in width to variable shallow depths as required for the laying of tubing, conduit, etc. . . . . (57) New high-voltage, one-piece, pin-type porcelain **insulators** are being manufactured by Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis. . . . . (58) A $\frac{3}{16}$-in. tempered plate glass shield to protect its sealed-beam lighting unit has been added to the high-intensity Jetlite **trouble-shooting lamp** manufactured by Burton Manufacturing Co., Santa Monica, Calif.

(59) A new 4-ton Weathertron split-system **heat pump** has been made available by General Electric's Air Conditioning Department, Tyler, Texas . . . . (60) A new 28-kv **power cable** with 33/64-in. thick butyl-rubber insulation has been developed by the National Electric Division, H. K. Porter Company, Inc., Pittsburgh 19, Pa. . . . . (61) Anaconda Wire and Cable Company, New York, N. Y. announces the development and production of silicone-Teflon **magnet wire** with nickel-plated copper conductors.

(62) Smooth, gradual control of electric heat unit ventilators in schools, hospitals, and other large buildings is provided by a new pressure-electric **switch** available from the Powers Regulator Co., Skokie, Ill. . . . . (63) Electromode Division of Commercial Controls Corp., Rochester, N. Y., has announced new Hi-heet automatic **tape** and **cable** which prevent freeze-ups. . . . . (64) Ettco Wire & Cable Corp., Brooklyn, N. Y., has announced that the new **THW building wire** has a rating of 75 deg C and can be used for wet and dry locations. Available in all colors and sizes.



Positive, red pilot light in push button of GE 5491-2. Switch shows up bright — day or night.

First push switch with built-in pilot light does the work of two devices!

Call your General Electric distributor today!

Your customers will want the new G-E Pilot Push-Button Switch the minute they see it! There's a jeweled pilot light, built right into the button, that glows bright red when the switch is ON.

You get a switch *and* pilot light in *one* device that fits standard toggle switch plates and is easy to wire. It's the perfect switch for "hidden" lights such as garage, porch, cellar or storeroom lights — and for outlets, appliances or equipment that customers want to *know* are ON. The neon pilot bulb operates for less than 1¢ a year and lasts up to 20 years.

Available in single pole or 3-way; 15A, 120/277V AC. Listed by U.L.; meets REA specifications.

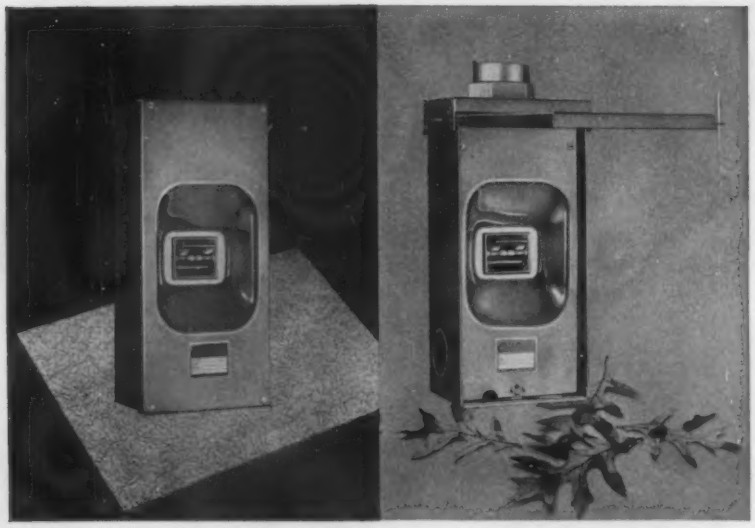
Ask your helpful General Electric distributor to show you the "new idea" wiring devices that mean more business for you. General Electric Company, Wiring Device Department, Providence 7, R. I.

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GENERAL ELECTRIC



NEW...FROM HEINEMANN



200 AMP SERVICE ENTRANCE EQUIPMENT

. . . small box
. . . big breaker

Customers looking for more electrical power will find a lot to like in this unit. Capacity is a full 200 amperes. "Full" because the Heinemann hydraulic-magnetic breaker makes de-rating as obsolete as yesterday's weather forecast. You can put this equipment next to heat lines, or let it sizzle in the summer sun. It always carries full rated current, always trips as specified. No thermal elements . . . no temperature-caused nuisance tripping.

Installation? Painless. There's enough space inside for two hands *and* wire. Solderless screw-type connectors save time and trouble. Knockouts are plentiful, placed so conduit can be run-in from any angle.

Cost? A little less than you are used to paying for equipment that supplies equal capacity *after de-rating*.

The size is another pleasant surprise . . . slightly smaller than fused pull-outs of the same rating. The equipment is rated at 120/240V AC, two- or three-wire service, and is available in indoor or raintight, tamperproof outdoor enclosures of heavy-gauge steel.

MORE QUESTIONS? SEND FOR BULLETIN 1003

HEINEMANN
ELECTRIC COMPANY
132 Plum Street, Trenton, N. J.

Circuit breakers

S.A. 2044

Catalogs & Bulletins

(65) STATIONARY BATTERIES. 12-page illustrated booklet (Form 4676) gives detailed operating instructions and maintenance hints for batteries used in such applications as switchgear and supervisory control, standby power, and emergency lighting. Exide Industrial Div., Electric Storage Battery Co.

(66) ELECTRIC HEAT CONTROL. Form P-80 describes new pressure-electric switch to provide smooth, gradual control of electric heat unit ventilators in schools, hospitals. Powers Regulator Co.

(67) SCHOOL LIGHTING. 4-page folder includes detailed descriptions and illustrations of fixtures designed to meet present-day high-level school lighting standards at savings in initial cost and maintenance. Smithcraft Lighting.

(68) SILVER-ZINC BATTERIES. 6-page brochure provides design details for over 20 manual and automatically activated batteries for one-shot single use installations in operational weapons systems. Cook Batteries.

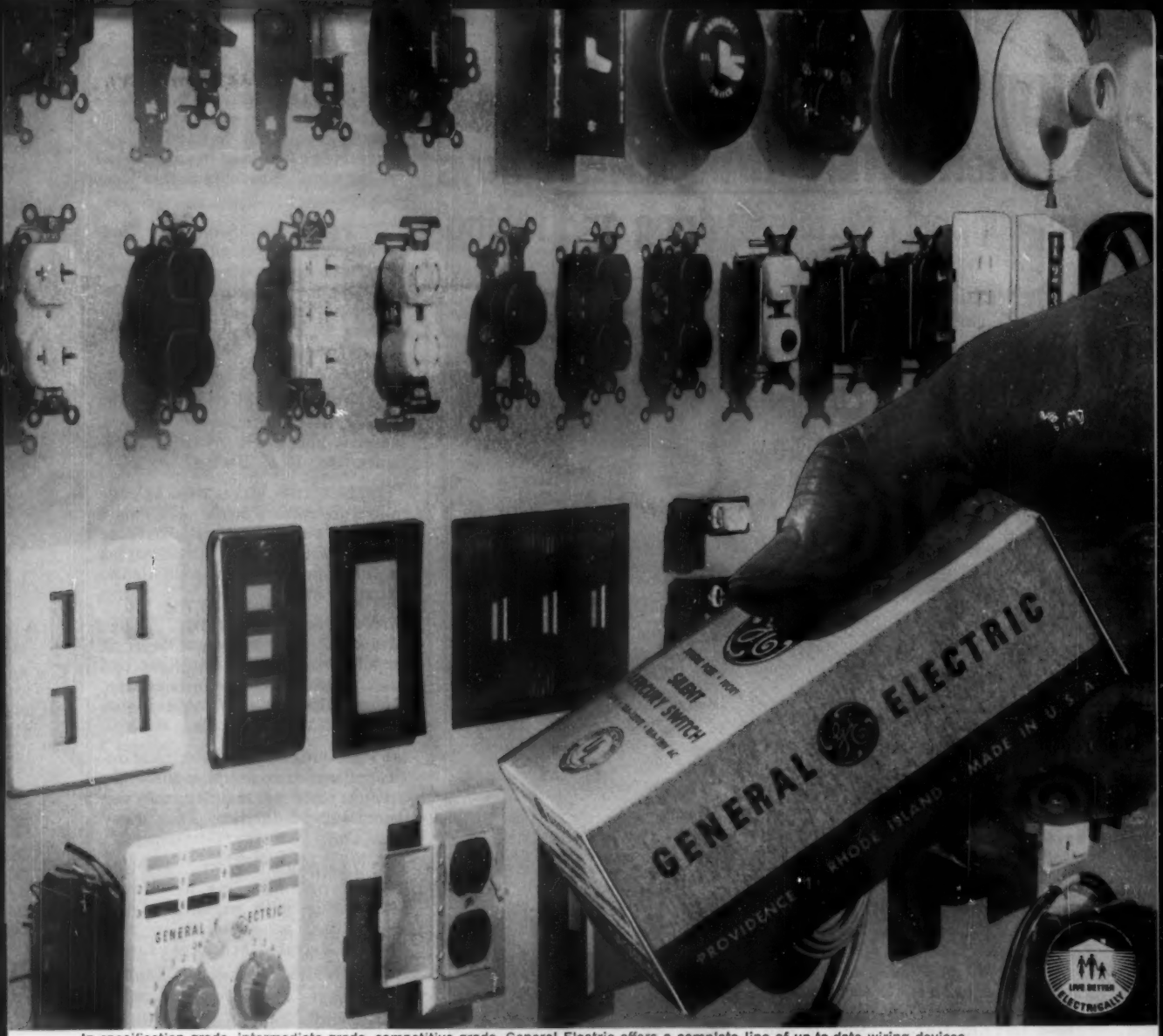
(69) WATTHOUR METERS. Bulletin GEA-6683, 8 pages, discusses problems posed by tilted meters, providing test results and data showing superiority of magnetic-suspension meters. General Electric Co.

(70) LIGHTING FIXTURES. 4-page catalog describes new Dayna Meridian collection of Oriental pendants. Dayna Lighting, Inc.

(71) VENTILATOR CONTROL. Application manual shows control applications for unit ventilators including complete cycles of operation, damper sequence charts, and specifications for precise temperature control. Barber-Colman Co.

(72) TRANSFORMERS. Bulletin DT8 covers design and operating features of pad-mount transformers for underground distribution systems with ratings from 24 through 167 kva single phase and 75 through 500 kva 3-phase, at 2.4 through 13.2 kv. Line Material Industries.

(73) POWER CONTROL UNITS. Bulletin S-1075, 8 pages, describes five different systems offered in new line of units utilizing magnetic gating amplifiers driving silicon-controlled rectifiers. Magnetic Amplifiers, Inc.



In specification grade, intermediate grade, competitive grade, General Electric offers a complete line of up-to-date wiring devices.

New General Electric devices provide all the quality features that you appreciate

Call your General Electric distributor today!

Only General Electric gives you so many of the time savers and new ideas that you've been looking for, in a complete line of more than 1500 dependable, competitively-priced wiring devices.

You get easy-to-wire, screwless Pressure-Lock* terminals in many types of G-E wiring devices — with extra-large holes that accept two wires or a loop, for quick carry-through wiring — and a release mechanism that works easily.

You get long, 7/8" plaster-cleaning mounting screws, held captive in the strap; rigid "through" straps that hold alignment; shallow specification grade devices that leave more room for wires.

Your local General Electric distributor will welcome the opportunity to help you select the G-E wiring devices that are best for your particular needs . . . from the finest specification grades to the lower-cost competitive grades. General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

*Trade-mark of General Electric Company

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NOW···GLOBE OFFERS···
two new INTERCHANGEABLE trays
for support of cables, wiring and tubing

★ Engineered for uniform design and easy installation
★ Steel or aluminum construction
★ Complete accessories for SPEEDIER Installation
★ No sharp edges to damage cables
★ Complete interchangeability



Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

Distributors are to be found in all principal cities—consult the yellow pages in your phone book under "Gratings" or "Conduits" for the one nearest you.



109

PRODUCTS DIVISION

The **GLOBE** *Company* MANUFACTURERS SINCE 1914

4032 SOUTH PRINCETON AVENUE, CHICAGO 9, ILLINOIS

(74) TROLLEY SYSTEM. Booklet describes Penrose system which completely covers all live parts and eliminates hazards of exposed crane trolley wires. Northbrook Products, Inc.

(75) PRESSURE CONNECTORS. Vest-pocket-sized 36-page book for electrical construction and plant maintenance electricians gives time-saving applications of pressure connectors for solderless wire splicing and terminating. Buchanan Electrical Products Corp.

(76) SAFETY LIGHTING. 20-page catalog describes line of flashers, lanterns and torches with maintenance tips. R. E. Dietz Co.

(77) LIGHTING FIXTURES. 64-page miniature catalog contains complete sections on indoor and outdoor lighting with detailed specifications on dimensions, wattage and finishes. Progress Mfg. Co., Inc.

(78) PRECISION SWITCHES. 2-page data sheet describes new 2-circuit switches for use on machine tool limit and control mechanisms. Micro Switch, Div. of Minneapolis-Honeywell Regulator Co.

(79) LUBRICATING and electrical devices intended to assist industry in cutting costs of maintenance and increasing production. Trico Fuse Mfg. Co.

(80) LUMINOUS CEILINGS. Ten different types, including new Leaf-Lite ceiling with unlimited color possibilities, are covered in new 8-page illustrated brochure. Luminous Ceilings Inc.

(81) WELD CONNECTIONS. Wall chart details simplifies procedures for making permanent electrical connections to any copper conductor or steel structure without an external power source. Burndy Corp.

(82) LIGHTING SUPPORTS. 8-page Bulletin G-2 discusses channel-type supports for installing wiring and electrical lighting fixtures in plants, industrial and commercial buildings. Steel City Electric Co.

(83) SAFETY SWITCHES. New catalog covers complete line of light, standard and heavy-duty safety switches including dimensions, capacities, voltages and horsepower ratings. Frank Adam Electric Co.

(84) LOAD CONTROL SYSTEMS. Bulletin GET-2916, 4 pages, discusses theory and application of tie-line load, frequency load, reactive power, and power-limiting control in industrial plants. General Electric Co.

(85) CARBON BRUSHES. Reprint of technical article describing carbon brush characteristics and operating properties covers contact resistance, coefficient of friction, conductivity, abrasiveness, carrying capacity and commutator surface speed. Speer Carbon Co.

(86) TURBINE PUMP MOTORS, Type HV-1, designed for short-coupled industrial pumping service, are described in new brochure F-1975, including explanation of Microset coupling permitting speedy fine-adjustment of pump impellers without shaft disassembly. U. S. Electrical Motors Inc.

(87) LAMP SOCKETS. 4-page brochure covers a broad cross-section of various types of bracket-mounted sockets for popular types of incandescent and neon glow lamps. Leecraft Mfg. Co., Inc.

(88) MOTOR DRIVES. 96-page Catalog M-592 explains in brief copy and many illustrations wide assortment of styles, modifications and accessories available in complete line of mechanical variable-speed Motodrives. Reliance Electric and Engineering Co.

(89) EPOXY RESINS. New brochure explains latest methods of encapsulating electric motors with epoxy resins for experienced users as well as repair shops just becoming interested in the process. Insulation and Wires Inc.

(90) FHP MOTORS. New form for specifying special-purpose fractional-horsepower motors for heavy-duty applications. Back side contains general information on standard costs for electrical and mechanical modifications; front side is meant for listing information regarding application intended. Motor Appliance Corp.

(91) INDUSTRIAL RECTIFIERS. 6-page Bulletin RE 1.1a covers heavy-duty silicon-type rectifiers designed for industrial use where continuous operation and heavy demands require an uninterrupted 250-volt dc power source. Allis-Chalmers.

(92) ELECTRIC HEATERS. Catalog GC-106 features technical and descriptive information on the uses of full line of heaters. Berko Electric Mfg. Corp.

(93) BREAKER ACCESSORIES. 12-page Bulletin GEA-6757 describes complete line of industrial molded case circuit breaker accessories and modifications. General Electric Co.

YOU CAN DEPEND ON

ROYAL ELECTRIC

PORTABLE CORD

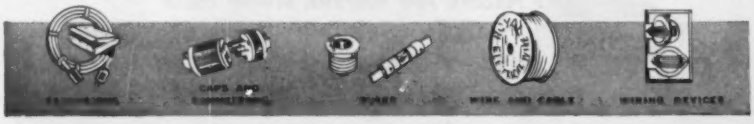


Put it to the test on your work . . . see for yourself why so many leading contractors and maintenance men insist on Portable Cord and Cable with the familiar and trusted Royal brand. You'll find Royal goes all the way to produce easy-working, long-lasting cord . . . with durable, handy packaging for maximum protection and time-saving workability.

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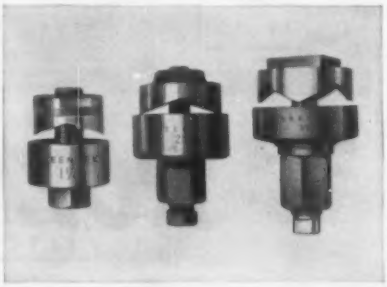
NEW...Ratchet Knockout Punch Driver... 6 times faster action



GREENLEE NO. 1804 RATCHET KNOCKOUT PUNCH DRIVER punches holes for ½″ to 3″ conduit 6 to 8 times faster than wrench method. Handy ratchet handle and special anti friction, fast-lead thread in the ball bearing assembly give fast approach and cutting action. One complete revolution of handle easily drives punch through 10-gauge metal. Lightweight . . . only 6½ pounds. Use it with all standard GREENLEE Knockout Punches from ½″ to 3″ and Round Radio Chassis Punches 1 1/16″ and larger. Packed in strong metal carrying case with compartment for storing 2″ and smaller knockout punches. May be purchased with or without punch sets. See your distributor or write for Bulletin E-289.

Cut conduit holes quickly, easily with Greenlee Knockout Punches

Complete range of knockout punches to make openings for all standard conduit sizes ½″ - 5″. Fast, easy cutting through 10-gauge metal. Every cut is quick and clean — slug falls free in die. Hand, ratchet, or hydraulic driver operated. Wide choice of sets.



OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK . . . CONDUIT BENDERS, CABLE PULLERS, PIPE PUSHERS, BORING TOOLS

GREENLEE TOOL CO. GREENLEE

1844 Columbia Ave., Rockford, Illinois

(94) UNIT SUBSTATIONS. 44-page booklet PSG 559 contains descriptions of articulated and integrated, indoor and outdoor secondary unit substations. Pennsylvania Transformer Div., McGraw-Edison Co.

(95) DEMAND METERS. Bulletin GEA-6892, 8 pages, covers line of redesigned printing demand meters for precision recording of loads. General Electric Co.

(96) PUMP MOTORS. Bulletin F-1953 covers new Holloshaft turbine pump motors, including principles of design with cutaway view of motor. U. S. Electrical Motors Inc.

(97) INSULATING VARNISH. Data and fact file covers uses and care of insulating varnish suitable for electrical motor repair shop uses. Insulation and Wires Inc.

(98) GENERATING SETS. Folder gives specifications of diesel engine-driven electric generating sets for such rugged operations as oil fields and mining camps, rated from 3000 to 6000 watts air-cooled and 10 kw to 230 kw water-cooled. D. W. Onan & Sons Inc.

(99) MECHANICAL DRIVE. 6-page Bulletin 3600 discusses the Allispede mechanical adjustable-speed drive for such applications as material handling, dairy food and chemical processing, and woodworking and machine tools. Louis Allis Co.

(100) BASIC SWITCHES. Catalog 63, 20 pages, covers four small switch groups: postage-stamp-sized switches, 2-circuit switches, subsubminiature switches and subminiature switches. Typical auxiliary actuators and assemblies are shown with each type. Micro Switch.

(101) GEAR INSTALLERS. 24-page book contains complete descriptions of pulling systems, including rams, pumps, and hydraulic presses for installing and removing gears, etc. Owatonna Tool Co.

(102) CARTRIDGE FUSES. Bulletin 1330, 12 pages, covers line of Econ dual-element fuses, including design, construction and operation, 0 through 60 and 70 through 600 amps, 250 and 600 volts. Economy Fuse Div., Federal Pacific Electric Co.

(103) TRANSFORMERS. 12-page Bulletin GEA-6984 describes full line of medium transformers, open and sealed dry type, distribution equipment type, and integral distribution centers. General Electric Co.

(104) DC VOLTMETER. Dual-sensitivity instrument for measuring open-circuit structure-to-soil voltages in corrosion control and cathodic protection circuits is covered in Bulletin 1-3. Associated Research, Inc.

(105) FLOODLIGHT STANDARDS. 12-page bulletin includes drawings, dimensions, specifications and suggested wiring methods for complete line. Lighting Standard Div., Kerrigan Iron Works Inc.

(106) CIRCUIT BREAKER interrupting capacity chart. Revised version enables user to select and order proper breaker for each application. Westinghouse Electric Corp.

(107) MASONRY ANCHORS. Revised, enlarged edition of "Masonry Anchoring Handbook," 48 pages gives information for each type of anchor and drill, including application tables, dimensions and specifications. Rawlplug Co., Inc.

(108) RESIDENTIAL LIGHTING. New 1960 52-page catalog includes complete descriptions and illustrations of wall and ceiling fixtures in traditional, colonial and contemporary design. Emerson Electric Mfg. Co.

(109) NET LIGHTS. Catalog insert sheet describes fixtures made of fish net tautly stretched over rings of various dimensions. Howard Miller Clock Co.

(110) RESISTORS. 4-page Bulletin 6715 describes Tab-Weld resistors in ratings from 13 to 500 amps for severe-duty jobs where vibration-proof, non-breakable construction is important. Electric Controller & Mfg. Co.

(111) CONTROL CENTERS. Bulletin PL6200, 16 pages, illustrates advantages and adaptability of ac motor control centers in several types of construction in a variety of enclosures. Clark Controller Co.

(112) LIGHTING STANDARDS, brackets and mast arms for street and highway, floodlighting, and traffic signal applications are detailed in new 65-page catalog. Lighting Standard Div., Kerrigan Iron Works Inc.

(113) LAUGH BOOK. New booklet contains jokes and cartoons suitable for use by business people called upon to make an occasional public address or luncheon speech. Precision Equipment Co.

(114) SAFETY SWITCH. Bulletin PL 250-ND describes line of switches designed for normal duty industrial and commercial use, rated at 30 and 60 amps. American Electric Switch Div., Clark Controller Co.

FAST, Lightweight
Greenlee Hydraulic Benders for 1/2"-4" Conduit and Pipe

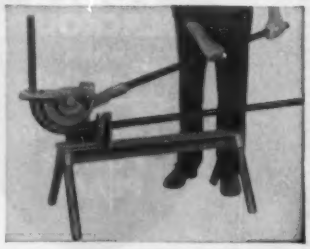


full 90° bend with one ram stroke

NEW GREENLEE No. 883 Lightweight Hydraulic Conduit Bender quickly makes accurate bends in eight sizes of conduit from ½" through 3" . . . up to 90° with one ram stroke. Operates with either a portable power pump or hand pump. Makes 90° bend in 3" conduit in approximately 1 minute with power pump . . . only 10 minutes with hand pump. One set of rotating supports for all eight conduit sizes . . . supports also serve as rollers for wheeling bender from job to job. Conduit is easily inserted and removed from front of bender. "Quick-removal," positive-locking support pins cannot come loose. Bending gauge included for accurate results with minimum calculations. Get details now on the complete GREENLEE Lightweight Bender line that includes three models for ½" - 2" . . . ½" - 3" . . . and ½" - 4" conduit.

new, fast ratchet bender for ½", ¾", 1" conduit

GREENLEE No. 1800 Ratchet Hand Bender permits short, powerful strokes for easy, quick bending up to 90°. Swing-away clamp makes loading simple. Sturdy T-iron base sets anywhere or receives threaded pipe legs of any desired length. Built-in bending gauge reads 0 to 90°. See your distributor for a demonstration, or write for descriptive Bulletin E-291.



A COMPLETE LINE OF HYDRAULIC AND HAND BENDERS FOR CONDUIT AND TUBING

GREENLEE TOOL CO. GREENLEE

1757 Columbia Ave., Rockford, Illinois



MODEL P-55-C

Weatherproof All-Purpose

POWER OUTLETS

FOR OUTDOOR CONSTRUCTION, INDUSTRY, FARMS, RANCHES AND MOBILE HOME PARKS!

MODEL P-55-C, as illustrated, has a 60 amp, 250 volt, 4 wire power receptacle, protected with a two pole 50 amp circuit breaker. Also has a grounded type duplex receptacle protected with a one pole 20 amp circuit breaker. Top hub and bottom KO's facilitate overhead or underground connections. Completely weatherproof. Cover closes completely when in use and can be padlocked.

Over 100 other standard models to choose from in fused or circuit breaker types with 15 to 60 amp, 3 and 4 wire receptacles.

SEE YOUR LOCAL ELECTRICAL DISTRIBUTOR OR WRITE

Midwest ELECTRIC PRODUCTS, INC.

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PROTECTED from POWER BLACKOUTS with a Katolight EMERGENCY POWER PLANT

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KATOLIGHT EMERGENCY POWER PLANTS are built to specifications for institutional, industrial and commercial installations. Up to 1,000 KW to meet every requirement.

WRITE TODAY FOR DETAILS!

YOUR INQUIRY BRINGS A PROMPT REPLY.

KATOLIGHT *CORPORATION* BOX 691-53 MANKATO, MINNESOTA

(115) WIRING DEVICES, lamps and specialty products are illustrated and described in new 80-page catalog. Eagle Electric Mfg. Co., Inc.

(116) TRANSFER SWITCHES. Bulletin 07500-G, 4 pages, covers new relay control features of Trans-O-Matic automatic transfer switches designed for 600 volts, 800 amps, with IC to 50,000 amps rms. Lake Shore Electric Corp.

(117) SILICON RECTIFIERS. New data sheet describes power rectifiers designed for operation at current levels from 1 to 15 amps single-phase half-wave. Syntron Co.

(118) UNDERFLOOR DUCT. Materials for underfloor electrical distribution systems—duct, junction boxes and fittings—are described in 20-page Cat. 35. Walker Brothers.

(119) ADJUSTABLE-SPEED DRIVES from ½ through 4 hp. 12-page Bulletin D-2507 gives detailed performance and application data on complete line. Reliance Electric and Engineering Co.

(120) CLUTCHES, Bulletin R-6304-1B, 20 pages, provides design, specification and application material on line of electromagnetic clutches with torque capacities from 1.8 through 18,000 lb-ft. I-T-E-Circuit Breaker Co.

(121) VARIABLE TRANSFORMERS. 8-page Bulletin P559 describes line of Powerstats up to 12.5 amps constant-current rating in open, enclosed, fused, cord plug, or enclosed terminal models. Superior Electric Co.

(122) INFRARED HEATERS. 8-page catalog describes complete line of Chromalox far-infrared heaters and controls for drying, curing and baking of plastic, textiles, paper and inks, ceramic products and metal work. Edwin L. Wiegand Co.

(123) BATTERY CHARGER operation and maintenance. Short course covering vertical motor-generator chargers for industrial truck batteries and other motive power applications is presented in Form 5845. Exide Industrial Div., Electric Storage Battery Co.

(124) ELECTROMAGNETIC CONTROLS including ac relays, solenoids, automatic engine-starting controls, automatic battery chargers, break-glass switches, close differential relays and remote control switches are described in Kit 57-SAK. Automatic Switch Co.

New Books

Elevators: Electric and Electro-Hydraulic Elevators, Escalators, Moving Sidewalks and Ramps, by Fred A. Annett. Third edition; 400 pages; $11.50. McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y.

A comprehensive and practical treatment of vertical-transportation equipment as used in office buildings, hotels, apartment houses, private homes, and other buildings. It provides a useful and authoritative source of information for electrical workers and mechanics interested in the construction, operation and maintenance of such equipment.

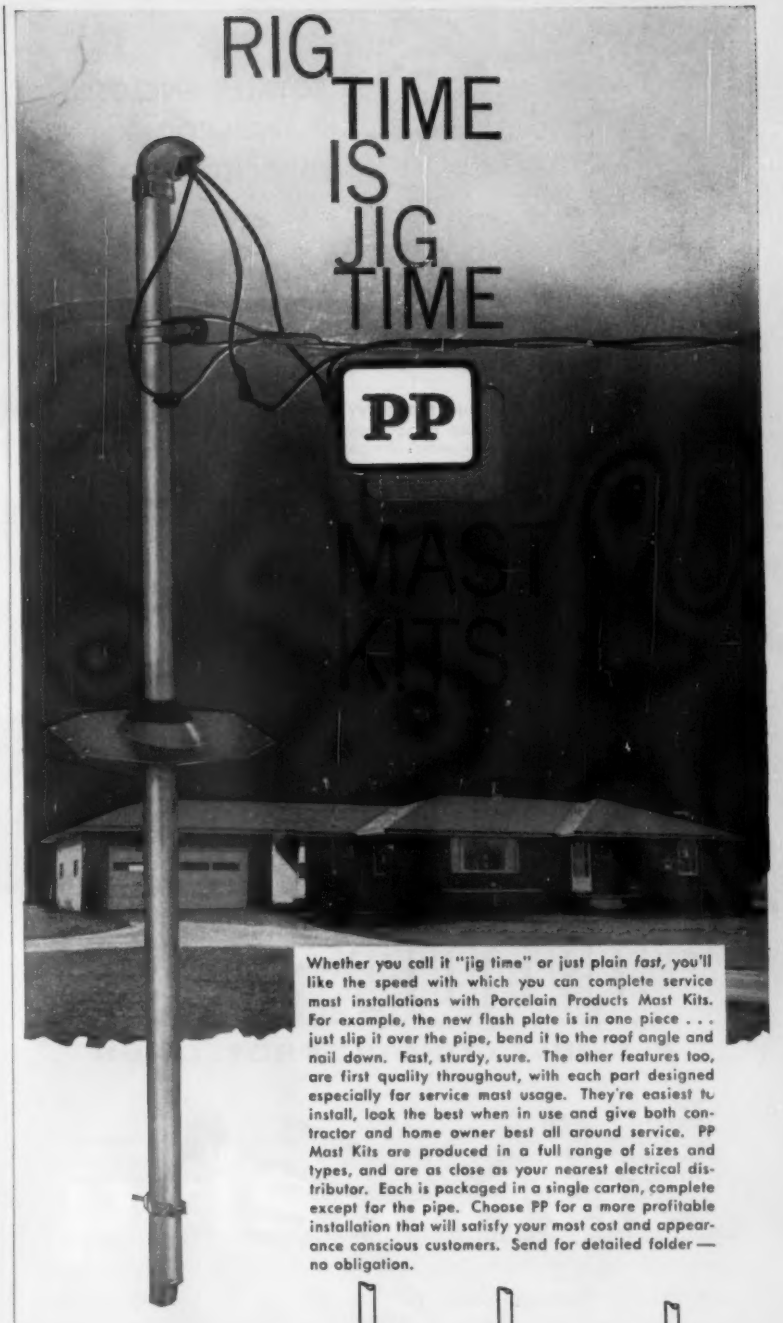
Handbook of Electronic Control Circuits, by John Markus. 350 pages; $8.50. McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y.

A comprehensive compilation giving industrial electronic and design engineers a selected reference to over 250 electronic circuits, each complete with values of components. From it can be obtained the salient points of a number of circuits of a given type as a guide for choosing the most promising circuit for a particular application.

Epoxy Resins: Market Survey and Users' Reference, $18.50. Materials Research, Box 363, Cambridge 39, Mass.

The first report of its kind on epoxy resins, pointing out many detailed ways in which businessmen in all of industry can save money by using epoxy resins as a protective coating, as part of his product, or in some other way. Prepared by nine recent graduates of the Harvard Business School, it is the result of extensive research and a survey of 1000 companies manufacturing, selling and/or using epoxies.

Manual Program. General Electric Co. has instituted a new program designed to present technical air-conditioning information in a concise, easy-to-understand manner in the form of specialized manuals. Major breakdowns of the manuals are Dealer Manual, Architect-Engineer Manual, Technical Manual (Vols. I and II), Product Manual, Installation Manual, Service Manual, and Renewal Parts Manual. Bulletins emerging from the Office of Technical Information and Training will automatically be sent to all registered manual hold-



Whether you call it "jig time" or just plain *fast*, you'll like the speed with which you can complete service mast installations with Porcelain Products Mast Kits. For example, the new flash plate is in one piece . . . just slip it over the pipe, bend it to the roof angle and nail down. Fast, sturdy, sure. The other features too, are first quality throughout, with each part designed especially for service mast usage. They're easiest to install, look the best when in use and give both contractor and home owner best all around service. PP Mast Kits are produced in a full range of sizes and types, and are as close as your nearest electrical distributor. Each is packaged in a single carton, complete except for the pipe. Choose PP for a more profitable installation that will satisfy your most cost and appearance conscious customers. Send for detailed folder — no obligation.

PP



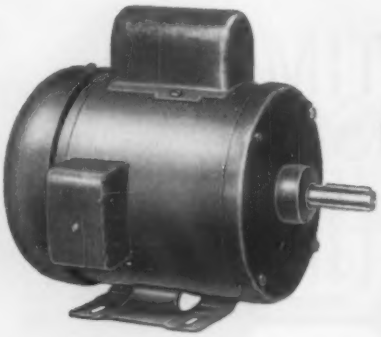
With upper courses of shingles removed, FLASH-PLATE is slipped straight down pipe.

FLASH-PLATE is twisted to conform to pitch of roof and nailed in place.

Upper courses of shingles are replaced and collar is slipped down into place.

PORCELAIN PRODUCTS CO.

225 N. PATTERSON ST. CAREY, OHIO



TOTALLY ENCLOSED
FAN-COOLED
CAPACITOR MOTORS

Dayton

Immediate Delivery
1/3 to 1-HP Sizes

DAYTON MAKES:
Split-Phase Motors
Capacitor Motors
Three-Phase Motors
Shaded Pole Motors
Repulsion-Induction
Gear Head Motors
AC-DC Motors
Generators, 115 & 230V
Fans & Fan Parts

BUILT FOR HEAVY-DUTY SERVICE on machinery, compressors, pumps, conveyors, farm jobs, etc. Acclaimed for dependability and long service. Heavy cast-iron totally enclosed, fan-cooled construction.

375% STARTING TORQUE. 1/3 to 1 HP sizes 1725 RPM, 115/208-230V, 60 Cy. 40° C. rise, continuous duty. Pre-lubricated ball-bearings. Rubber, and rigid mounted. Automatic overload protection. Nema frame sizes.

GRAINGER'S WHOLESALE CATALOG features Dayton, Westinghouse, General Electric, Emerson and Wagner Motors. All stocked at nearby Grainger Warehouse.

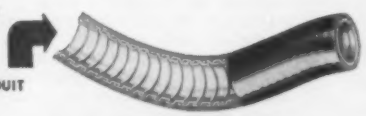
WRITE FOR NET-PRICE WHOLESALE MOTOR CATALOG
Dept. 76. 118 S. Oakley Blvd. Chicago 12

63 COAST-TO-COAST WAREHOUSES — W.W. GRAINGER INC — MOTORS - FANS - PUMPS GENERATORS - BLOWERS

VULNERABLE CIRCUITS NEED

LIQUATITE®

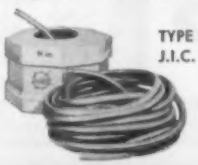
FLEXIBLE CONDUIT PROTECTION



Liquatite insures against costly down time due to wiring failure. It protects against contamination, vibration, motion and shock; proves ideal for "wet locations," around corrosives or where severe punishment may cause shorts or burn-outs.

Added to this, Liquatite installs as easily as any Flexible Conduit —follows contours, takes small radius bends necessary for hard-to-get-at locations.

Write today for free sample, costs and name of Distributor nearest you.



ELECTRI-FLEX COMPANY
P.O. BOX 128C • ROSELLE, ILLINOIS

ers. Single manuals are priced at $12.50; any two manuals $19.95; any three manuals $28.50. Subscription fee per year after first year for technical transmittals is $3.95. General Electric Co., Central Air Conditioner Div., Tyler, Tex.

Electric Motors and Generators, by Emery, Harrabin, Lee, Nixon and Rapson. 384 pages, $12.00. Philosophical Library, Inc., 15 E. 40th St., New York, N. Y.

An up-to-date, practical guide with many drawings and diagrams illustrating the use of motors and generators, principles of design, armature and rotor construction, field and armature windings, starters and speed control, generator primary power, testing, commutation and maintenance. Emphasis is on practical understanding rather than theoretical considerations.

Techniques of Plant Maintenance & Engineering. 266 pages; $10.00. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

This is the tenth volume in an annual series, presenting all papers read at the 1959 Plant Maintenance & Engineering Conference held in Cleveland in January, 1959. Included are 1,056 questions and their answers, submitted by engineers attending the conference. More than 70 charts, graphs and diagrams are reproduced. Representative titles of papers are "Maintaining Control Systems," "Maintaining Plant Utilities," and "Maintenance by Outside Contractors."

English - Spanish Comprehensive Technical Dictionary, Section II, by Lewis L. Sell. 1088 pages; $35.00. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y.

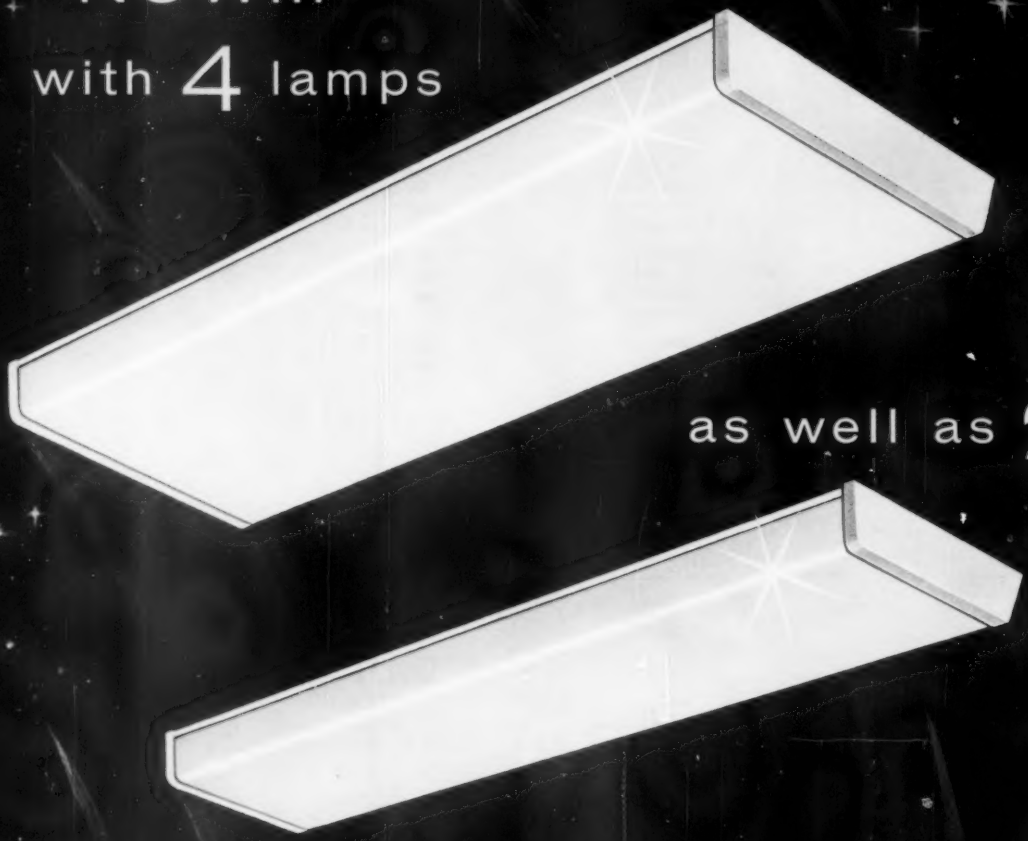
Over 400,000 of the latest technical terms and expressions in English and Spanish, including such fields as industrial electronics, automation, testing and measuring instruments, space travel, industrial photography, telegraph, telephone, guided missiles, space travel, and many others. The new volume forms an updating supplement to the 1944 edition.

Guide for Loading Oil-Immersed Distribution and Power Transformers (Standard C57.92); $2.00. American Standards Assn., 70 E. 45th St., Dept. PR67, New York 17, N. Y.

This is an appendix to the C57.12 series of standards which was revised and published in 1958 and covers general recommendations for loading oil-immersed transformers.

ZOOMING!

NOW...
with 4 lamps



as well as 2

the wonderful
WAKEFIELD **prismatic**

at
down-to-earth
prices

Below: Actual size photograph of clear plastic lens

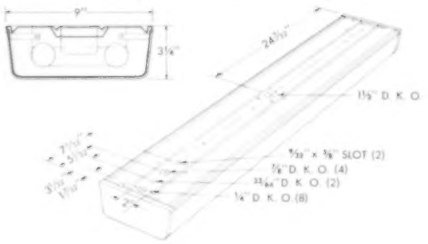
The Wonderful WAKEFIELD® prismatic™

TRADE MARK

now comes in a 4-lamp size to match the sensationally successful 2-lamper

PRISMATIC 50

2 Rapid Start Lamps



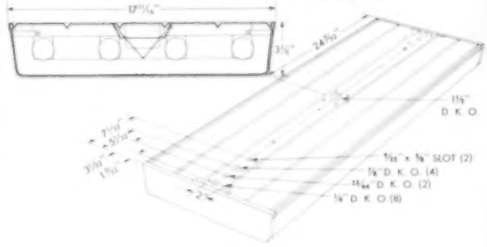
Catalog Number	No. of Lamps	Description	Std. Wt.—Lbs. Pkd.	Std. Wt.—Lbs. Unpkd.	Pkg. Quan.
R-214	2-F40T12/RS	Wakefield Prismatic	16 30	14 28	1 2

If your customer needs approximately 50 footcandles, install *one* Prismatic 50 for every 40 square feet of area.

Suggest to your customer that he paint his ceiling white and his walls a light color.

PRISMATIC 100

4 Rapid Start Lamps



Catalog Number	No. of Lamps	Description	Std. Wt.—Lbs. Pkd.	Std. Wt.—Lbs. Unpkd.	Pkg. Quan.
R-414	4-F40T12/RS	Wakefield Prismatic	34	28	1

If your customer needs approximately 100 footcandles, install *one* Prismatic 100 for every 40 square feet of area.

Suggest to your customer that he paint his ceiling white and his walls a light color.

eye-fi LIGHTING

Stores of All Kinds
Supermarkets
Florists
Beauty Shops
Barber Shops
Auto Show Rooms
Restaurants
Banks
Schools
Colleges
Laboratories
Libraries
Offices of All Kinds
Doctors
Dentists
Repair Shops
Drafting Rooms
Kitchens
Bathrooms

The acceptance of the Wakefield 2-lamp Prismatic has been phenomenal. Now we present a companion unit, a 4-lamp Prismatic, twice as wide and giving twice as many footcandles. Same fine quality, same fine design.

- **Graceful one-piece lens diffuser of light-stable clear styrene plastic.**
- **All steel parts white enameled.**
- **Diffuser easily slides out for cleaning and lamp replacement.**
- **Jefferson CBM/ETL, HPF ballast. IBEW, UL/CSA labeled.**
- **Readily installed directly on ceiling, singly or in continuous rows.**

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Distributed by Graybar houses in over 130 principal U. S. cities and by leading distributors in Canada . . .

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THE WAKEFIELD COMPANY — VERMILION, OHIO

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Litho in U.S.A.

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Fluorescent Lamp Life

QUESTION S36—In designing a fluorescent lighting system, a question has been raised as to the economy of switching lights off during the lunch period.

A number of contradictory ideas were presented, but all agree on the point that starting voltage of the fluorescent lamp would have to be determined to solve the problem. Since data consulted did not yield enough information, could you advise me of a method of calculating this starting voltage?—R.M.

ANSWER TO S36—Any lamp manufacturer will gladly supply you with curves showing "lamp life vs lamp starts," and you may be surprised to find how much lamp life is affected by lamp starts.

The economy of switching off lamps during lunch, at night or on weekends can be calculated. First, determine power cost (a savings) for those periods when the lamps are switched off. Next, determine the lamp life when the lamps are switched at this frequency and also when the lamps are not switched at these periods. Finally, determine replacement lamp cost plus labor cost per lamp.

At this point, it becomes a matter of simple economics, whether it is cheaper to switch off lights and save power cost, or leave on and reduce the frequency of lamp burnout and reduce lamp replacement labor cost.—J.A.M.

ANSWER TO S36—I am rather surprised to note that the question of the starting voltage seems to be important as to the economy of switching fluorescent lights on and off during the lunch period.

The way I have always heard it is that the fluorescent lamp is rated at so many hours of steady burning and so many starts. Every time the lamp starts, there is very definite effect on the life of the lamp.

Figures I have seen quoted are that 7000 hours is the life of the lamp under continuous use, whereas about 2000 starts will cut the life to about 2000 hours.

Therefore, if the lunch period ranges from about one-half hour to one hour, it is preferable to leave the lamps on, as the saving in power caused by shutting off the lamps is more than overbalanced by the reduction in life of the lamps. On the other hand, if the lights can be shut off for two hours or more, then it is preferable to shut them off.

I may say that we follow this practice in our own plant.—H.H.S.

Ground Detection

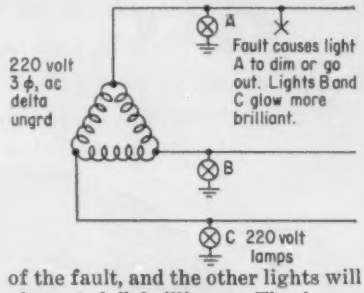
QUESTION T36—In our plant we have a 3-wire delta, 220-volt ungrounded distribution system. We need some device or means of detecting accidental grounds as we are unable to do so at present without disconnecting our power, area by area; and this is undesirable. Can someone suggest a solution to our problem?—J.A.M.

ANSWER TO T36—Where it is desired to follow a fault or an accidental ground, this can be done by superimposing on the line a high frequency signal. The usual signal that is impressed is a 1000-cycle tone which is fed into the power lines by an isolating capacitor or some other means, such as a transformer. This signal travels out and can be followed very readily with a pair of headphones and a sensitive amplifier. The newest type of equipment to do this job uses transistorized amplifiers, and the entire pickup which is the headphones and the amplifier can be very readily held in one hand.

Thus, one wanders around the building tracing the tone. Wherever the tone abruptly changes in intensity, one can be sure that there is some trouble at that location and a further investigation is required. —H.H.S.

ANSWER TO T36—We have a 220-volt, 3-phase delta system, ungrounded in a part of our plant, and we use ground detecting lights to signal when a ground is present. After a fault is detected, an instrument called a Brunt Fault Finder is used to locate the fault.

The ground lights are connected as shown in the sketch, and when a fault to ground develops on any of the phases, the light on that phase will glow at reduced brilliance, or go out depending on the impedance



of the fault, and the other lights will glow at full brilliance. The lamps should be rated 220 volts.

The fault finder is an instrument which can be used to locate a ground fault without disconnecting service or disturbing the load. It generates a high frequency signal through the faulty circuit, and an exploring coil in conjunction with an earphone is used to locate the fault. When the ground is passed the signal fades, and fault can be located.

Information on the Brunt Fault Finder can be obtained from the Parr Electric Co., in Newark, N. J. —R.E.B.

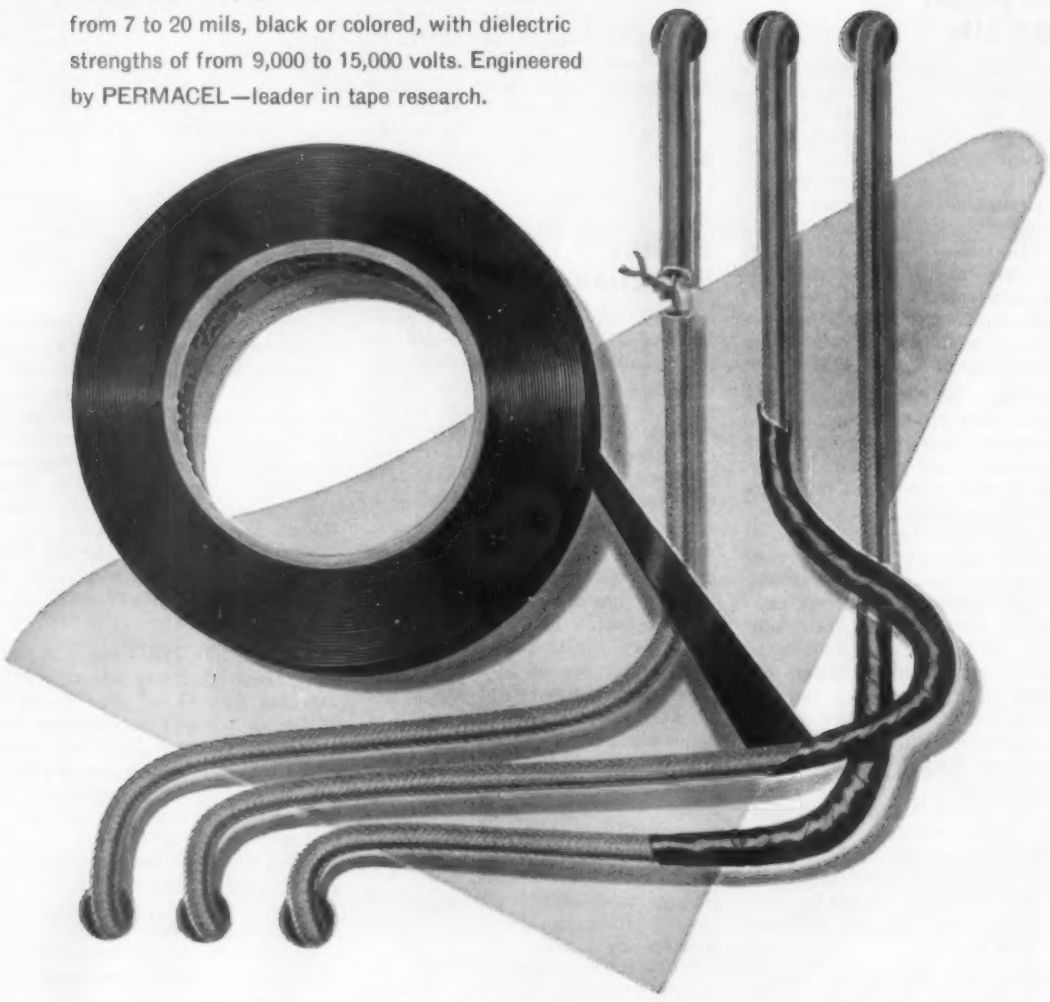
ANSWER TO T36—You will probably receive a lot of letters on this one, but I could not read it and let it go by without mentioning that the Allen Ground Detector, manufactured by the Excel Electric Service Co., is a device specially designed to cope with these problems.

Since nearly 90% of all grounds are less than 200 ohms, and are usually located on branch circuits and motorized equipment, the only way to find these faults quickly is to send an accurate and traceable low frequency signal of sufficient current through the loaded cables to the ground fault. The signal current is superimposed on the grounded phase conductor, and allows the operator to follow the grounded phase to the fault, with a super-sensitive signal receiver to the fault, with what can be carried in the hand or on a pole extension.

The first reading is taken at the main substation, and the fault is followed by means of further readings, along distribution points and sub-circuits until the branch circuit at fault is found. The signal is then traced to the ground fault.

Meanwhile, there is no need to open a single circuit. The detector finds the fault with power on.—C.A.M.

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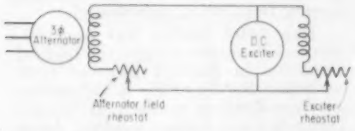
QUESTION U36—Where can I obtain information on electric band heaters, and pipe tracing cable approved for use in Class I, Groups C & D areas? The proposed application is melting solid pack metallic sodium in 55-gallon drums, and piping to reactor tank.—A.G.C.

ANSWER TO U36—Nelson Electrical Manufacturing Co., Tulsa, Okla., makes or will make, whatever you need along this line. Their products are very good. I have used some of them for pipe heating in Class 1 Group D areas.—W.E.G.

EDITOR'S NOTE—A check with Underwriters' Laboratories Inc. indicates that equipment such as mentioned in the question is not listed. Such equipment would have to be of a custom design. As a result, careful consideration should be given to the design of special equipment used in any hazardous location. The same tests that are used for listed equipment for hazardous locations should be employed with custom equipment. To be considered entirely safe, all equipment for use in hazardous areas should be submitted to a reputable testing agency such as Underwriters'. It is suggested that A.G.C. write to several of the manufacturers of listed equipment for hazardous locations for their assistance. Contact your nearest U.L. representative for a copy of their "Hazardous Location Equipment List." From this list you will undoubtedly find several manufacturers who can design the equipment in question.—J.H.W.

Generator Field Control

QUESTION V36—We have a 13.2-kv, 3-phase, 2500-kw alternator that has a direct-connected exciter. The field rheostat gives off a lot of heat that is nothing but loss. It has

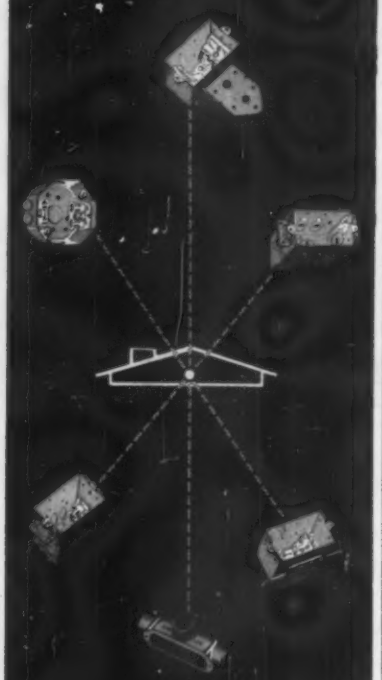


been suggested that this rheostat be eliminated and the field controlled entirely by the exciter voltage which is varied by the exciter rheostat. Is this practical?—H.G.R.

ANSWER TO V36—Yes, but undoubtedly the exciter rheostat would



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have to be replaced by one with more resistance to permit lowering the exciter field current and the exciter output voltage to a new lower value. This lower voltage would compensate for the absence of the alternator field rheostat.

For an installation of this size, it would be advisable to consult one of the larger motor control manufacturers regarding the application of an electronic field control device which will provide the proper exciter field current, requiring only a small, low-current potentiometer for manual control.—R.G.W.

ANSWER TO V36—What H.G.R. essentially questions is the practicability of reducing the exciter voltage by an amount equal to the IR drop in the generator field rheostat. Such a step may result in an unstable voltage.

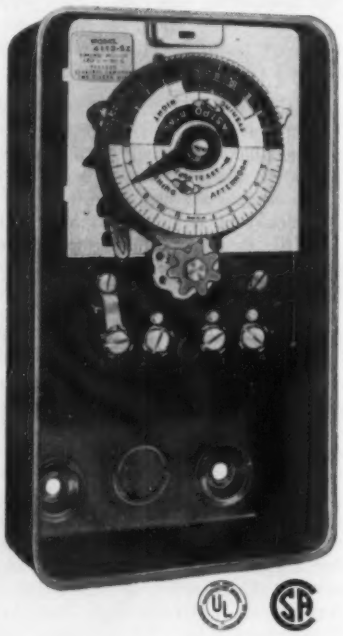
Even if the speed is held constant, characteristics of iron are such that the effective magnetic strength of the exciter field does not bear a constant proportion to the exciter terminal voltage. This is strikingly illustrated by a peculiarity noticeable when bringing the unit up to speed and voltage—that of a sudden and rapid rise of voltage with only a slight adjustment of the rheostat or the throttle. That is the region of unstable operation. A slight change in load, steam pressure, or field circuit resistance will be greatly magnified in the terminal voltage.

Consequently, direct current generators are designed to be operated well above the knee of the magnetization curve. Thus, stable operation is more assured. Good operation, therefore, calls for the exciter to be operated at voltages comfortably above the unstable region (but not necessarily at a constant voltage). The alternator field rheostat has a dual purpose —regulating the alternator voltage and regulating the exciter load.—L.E.B.

Can You Answer These QUESTIONS?

QUESTION E37—In cleaning electric motors during the regular course of maintenance, we have used carbon tetrachloride, but due to its toxic effect had to discontinue same. We then tried triclorethylene which was also found to be very toxic and required us to use a special respirator. We were inclined to think that while it was a good cleaner, it also being a varnish

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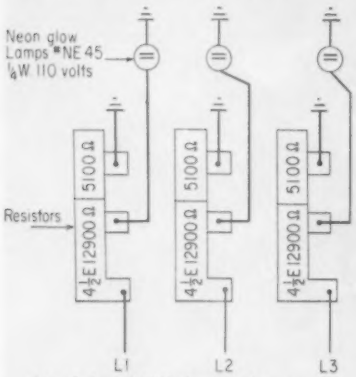
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thinner, that it was harmful to the insulation. We then used a Shell T-28 compound; this left a film and was slow in drying and therefore was not a very good cleaner for motor insulation. We are now trying Shell T.S. 28 mixed with 35% perchtorethylene and have not been using it long enough to properly evaluate same.

We require this cleaner for cleaning motors which are isolated and cannot be brought into the shop.

Any help your readers can give me will be most welcome.—J.S.B.

QUESTION F37 — Could anyone help me out in designing a circuit,



Line=3 phase 440 V. star 60 cycle ungrounded

that would enable me to install an audio signal on this ground detector.—S.P.M.

QUESTION G37—For the past eight years we have had the International Business Machines system of clock correction, the master clock controlling all indicating wall clocks. This is accomplished by the master clock and transmitters sending impulses out through the 480-volt distribution system, through step-down transformers and into the 120-volt secondary circuits.

The output impulse on these transmitters is 5 volts, 12 amps, 3500-6000 cycles, and are connected to the 480-volt, 60-cycle system.

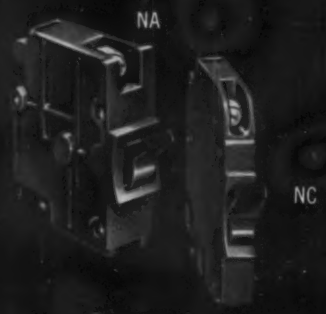
This year the Utility Company informed us our power factor was low. We purchased a bank of three capacitors, rated at 15 kw each, 480 volts, 3-phase. After connecting them into the 480-volt system, we lost our clock correction feature. The theory being, the capacitors are absorbing the impulses from the transmitters and preventing them from going out into the distribution system.—L.J.B.

PLEASE SEND IN YOUR ANSWERS BY DECEMBER 15



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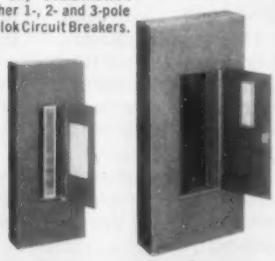
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Questions on the Code

Answered by:

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

Unbalanced Voltage—Delta Systems

Section numbers in parenthesis are those found in the 1959 NEC, where the same meaning is implied.

Q. *Please advise how to protect the motors connected to the 3-phase 440-volt system shown by the diagram below. I do not know the voltages over the phases of the primary conductors, but the secondary voltages vary as shown by "B" on the diagram. As far as I can see from the ground the transformers are connected as shown by "A." I am unable to obtain nameplate information. An engineer advises that he disapproves the hook-up. The power company serving the oil lease says that the voltages shown by "B" are about right. Two motors have recently burned out.*

The following motors are connected to this service; 1-25 *hp,* 1-7.5 *hp,* 3-2 *hp, and* 2-1 *hp. Most of them are located within* 100 *ft from the transformers. I am using magnetic or manual starters on the small motors.*

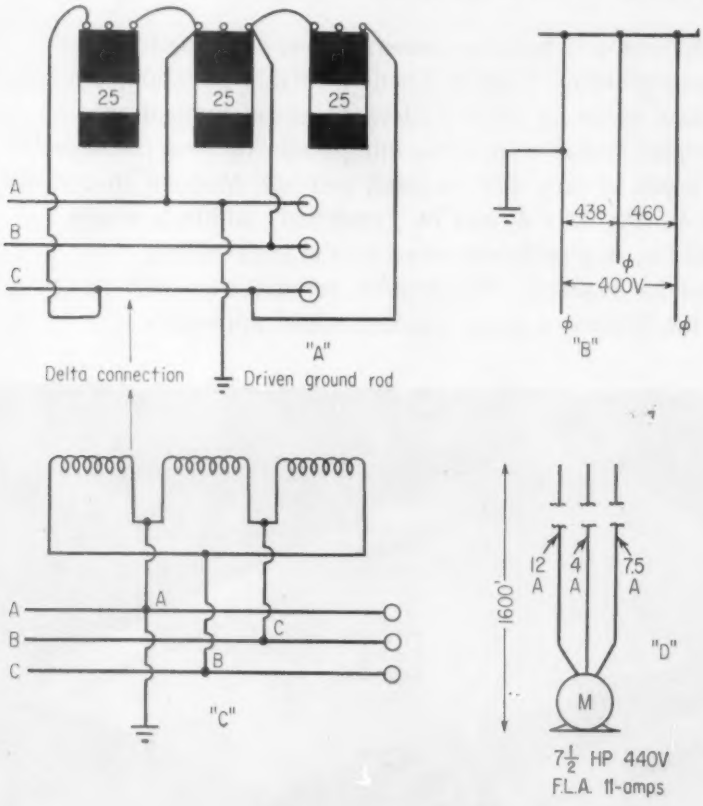
There is a 7.5 *hp,* 1225 *rpm motor about* 1600 *ft from the service. The phase voltage at this motor varies about the same at the transformer, as shown by "B." The current in the phase conductors serving this motor vary as shown by "D."*

I would appreciate any information you could give me on this matter.—K.K.

A. The transformer connections shown by "A" are in delta with one point of the delta grounded. This may be visualized more clearly by the reproduction shown by "C." The grounding of a 3-phase, 440-volt delta system is recognized by Section 2514 (250-5) of the code. There appears to be no criticism involved with the transformer connection. Such systems have given satisfactory service for many years. The principal factor involved appears to be the unbalanced voltages over the phases. A variation from 400 to 460 volts will result in unbalanced phase currents as shown by the current readings taken on the conductors serving the 7.5 hp motor. Such unbalanced voltages may be due to unbalanced load on the primary or the secondary of the transformers. Single phase loads not properly balanced over the phases could produce such an effect. If the phase voltages taken by you were near the transformers, or on the line side of the load, it appears to me that the power company is involved, and I would suggest that you notify the utility in writing, the same as you have described the situation in your question. When unbalanced voltages occur on the primary due to unbalanced loading, or other factors which may involve equipment, and the primary distribution system is owned and maintained by the utility, they may be held responsible for damage on the secondary which results from such unbalanced voltage. Usually utilities are very much concerned with such problems and cooperate in determining the factors responsible for the unusual conditions. In some cases, voltage regulators are installed to maintain equal voltage over the phases.

Assuming that the voltages are fairly well-balanced, the provisions of Section 4327 of the code (table 430-37, 1959 code) should be observed. This rule advises as follows:

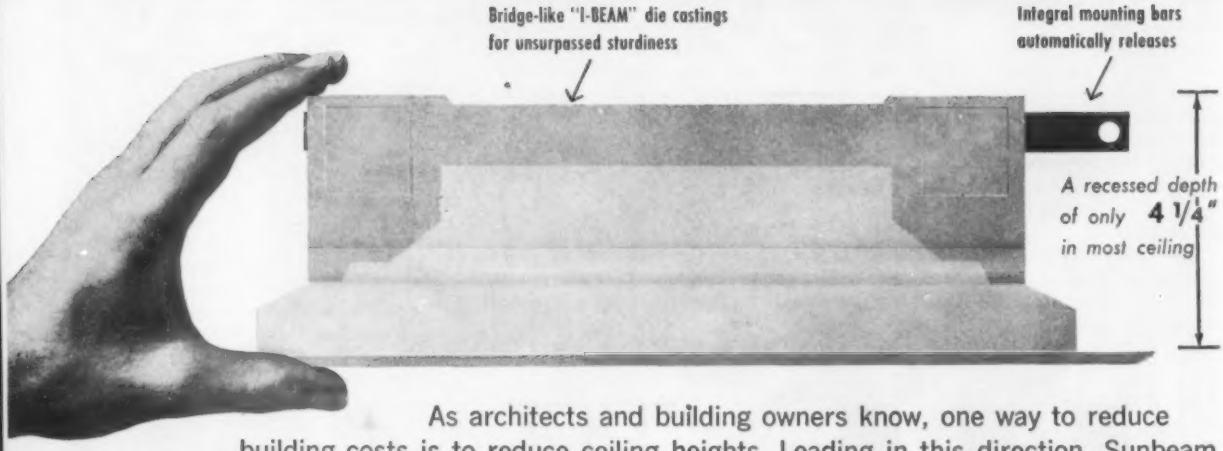
"In the case of distribution systems supplying wye-delta or delta-wye connected transformers (having the wye neutral point in the primary ungrounded or not connected to the circuit) the authority enforcing this code may require that three running overcurrent units be provided for the protection of 3-phase, 3-wire motors, if field experience in the territory of the authority indicates that a third unit is desirable because of motor winding failures at times of primary



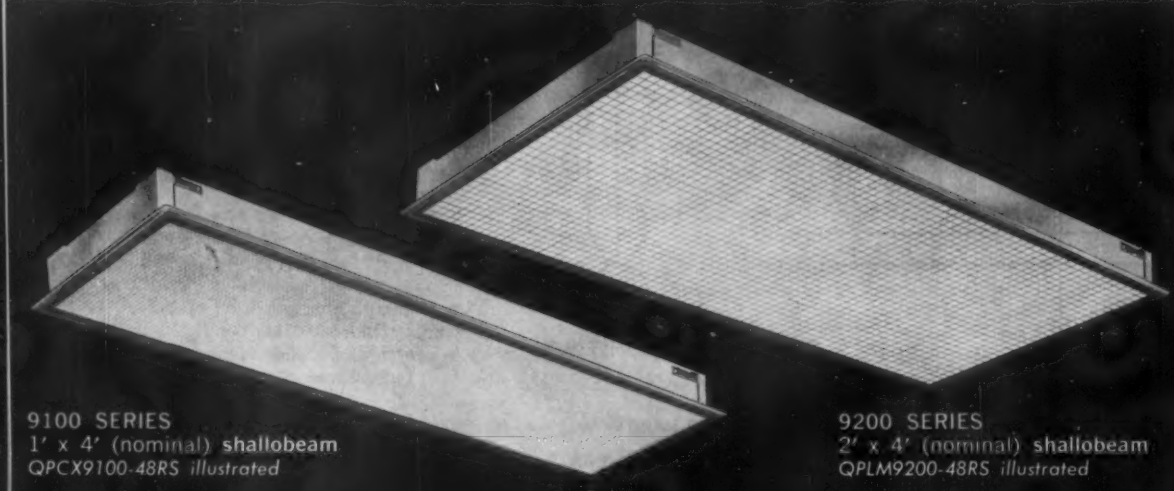
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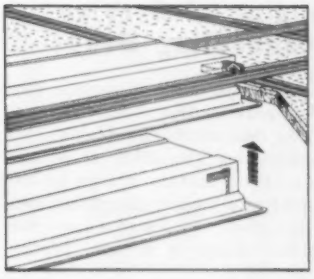
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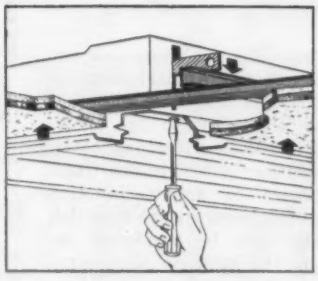


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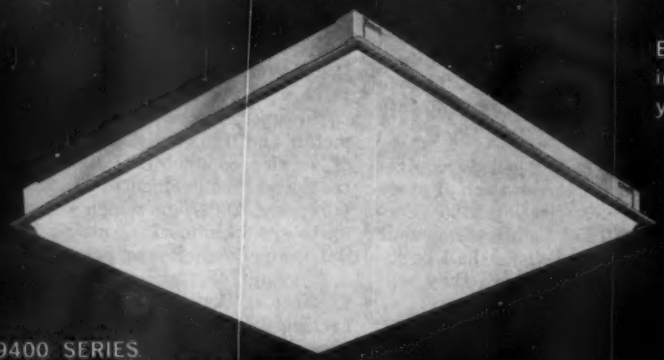




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single phase failures, unless the motors are otherwise adequately protected."

I believe you should solicit the cooperation of the utility with the advice that the unbalanced secondary voltages are not allright. In my opinion, they are quite abnormal.—B.A.McD.—11/59/1

Nonmetallic Sheathed Cable

Q. *There have been many small air conditioning machines, generally 220 volts, ½ to 2 hp. The electrician wants to run nonmetallic 3-wire cable from outside the switch boxes outside the house to underneath the floor thence to the machine. Should this cable be run in tubing to at least 12 in. under the house? I find nothing in the code covering this.—R.F.P.*

A. Nonmetallic sheathed cable may be used as outlined in your question. If it is to be run exposed and subject to the rain, etc., (damp and wet locations) it will have to be of the moisture and corrosion resistant Type NMC.

It does not necessarily have to be run in tubing or any other protective covering. Section 3364 (Section 336-6 proposed 1959 Code) covers the requirements for additional protection. In general if the cable is not subject to physical damage it may be run without additional protection.

Attaching the cable to the building surfaces or on running boards in such a manner that these surfaces or boards afford protection will preclude the need for the tubing, etc.

Where the cable is brought through a floor, protection by rigid metal conduit (not tubing) or metal pipe is required for a distance of at least 6 in. above the floor. This additional conduit or pipe acts as a sort of metal "kick plate" for the cable.—B.Z.S.—11/59/2

Junction Boxes

Q. *Can junction boxes be installed above a panel type ceiling when such panels are inserted in channelways and may be removed and replaced without disturbing the building finish or damaging the panels?—C.W.*

A. In the introduction of the National Electrical Code under "Enforcement" and I quote:

"This code is intended to be suitable for mandatory application by governmental bodies exercising legal jurisdiction over electrical installations and for use by insurance inspectors. The administrative authority supervising such enforcement of the code will have the responsibility for making interpretations of the rules, for deciding upon the approval of equipment and materials, and for granting the special permission contemplated in a number of the rules."

Section 3717 (370-19) states:

"JUNCTION BOXES BE ACCESSIBLE. Junction boxes shall be so installed that the wiring contained in them may be rendered accessible without removing any part of the building, sidewalks or paving."

From reading the above one can easily see that the interpretation of the question above is one that would be according to the interpretation of the electrical inspector. It has been our policy in the State of Tennessee to accept junction boxes as mentioned in the question when they can be rendered accessible by the removal of a panel that does not disturb the building finish. In many cases that we have had, especially in remodelling jobs where such ceilings have been used, the cost of making all junction boxes accessible without removing the panels would have been prohibitive.—R.E.W.—11/59/3

Overcurrent Device Location

Q. *What are objections to fusing air conditioning and heat pumps under floors where you have to crawl to get them and up in attics where you have to use ladders to get to them? Also explain if it is necessary to vent kitchen exhaust fans to outside in place of letting it go into attic.—H.R.*

A. There is a general requirement for the location of overcurrent devices. Section 2435 (Section 240-16, 1959 Code) states that the overcurrent devices shall be located in premises where they will be:

1. readily accessible,
2. not exposed to physical damage, and
3. not in the vicinity of easily ignitible material.

Based on the code definition of "Readily accessible—capable of being reached quickly, for operation, removal or inspection, without requiring those to whom ready access is requisite to climb over, or remove obstacles, or to resort to portable ladders, chairs, etc.," I would say that the installations you describe would not meet the code requirements.

As to the second part of your question, I might state that while the specific jurisdiction for this lies beyond the scope of the National Electrical Code, there are other applicable codes which I feel sure would prohibit the exhausting into the attic.—B.Z.S.—11/59/4

Grouping of Service Disconnecting Means

Q. *A house has two meters, the disconnecting means for one is in the basement, the disconnecting means for the other is in the garage. Both meters are to be replaced by one meter. Must the two disconnecting means now be grouped? This is a one family house.—T.B.F.*

A. Section 2360 (230-61 in proposed 1959 Code) lists the requirements for grouping of the disconnects under the following conditions:

1. disconnects are supplied at the same side of the building by
2. more than
   a. one overhead service drop, or
   b. one set of underground service conductors.

In Section 2301b, 2301c and 2321 (all consolidated in Section 230-2 of proposed 1959 Code) are given as exceptions to this grouping rule. Under the exception which permits separate service conductors for "Different Characteristics or Classes of Use" it would seem that the disconnects would be permitted to be at different locations.

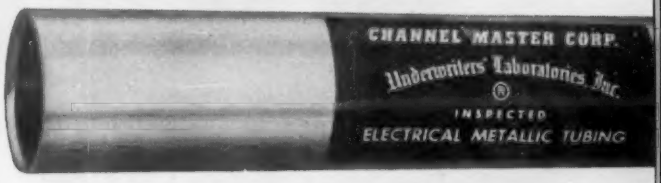
However, in the case of a single meter and thus only a single set of service conductors I would say that the requirements of 2351a (proposed 230-70g) which permits up to six disconnecting means in a

1. common enclosure, or
2. group of separate enclosures to serve in lieu of a single disconnecting means, would require the grouping of the two disconnects—B.Z.S.—11/59/5

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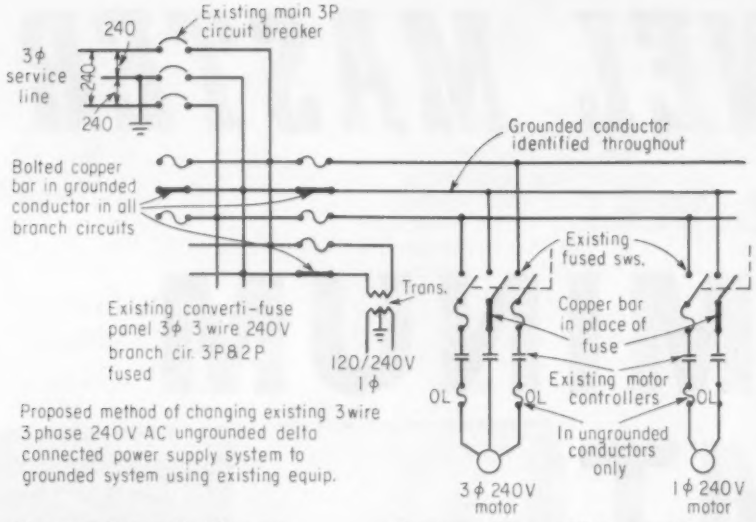
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Proposed method of changing existing 3 wire 3 phase 240 V AC ungrounded delta connected power supply system to grounded system using existing equip.

Grounding 3-Phase Delta System

Q. *The local power company is recommending changing the present 3-wire, 3-phase, 240-volt, ac, ungrounded delta connected power supply system in a local factory to a grounded system.*

The sketch above shows proposed method of changing system using existing equipment. Does it meet code requirements? Would a new installation of this type permit using 3-pole (2 fuse and solid neutral) equipment?—F. S.

A. According to the provisions of section 2514 of the code, (250-5, 1959 code) it is recommended that an ac system, where the voltage to ground does not exceed 300 volts, be grounded. In the example presented we have a 3-phase, 240-volt system which according to the definition of "voltage to ground" has a voltage of 240 volts to ground. In view of the foregoing the code actually recommends that this 240-volt system be grounded. There are three methods of procedure which may be followed. One would be to ground the mid-point of one phase; the second would be satisfied by the use of a zigzag grounding transformer; and the third, as recommended by the utility, is to ground one phase of the delta as shown by your diagram. The provisions of Section 2525-d (250-25) recognize this third procedure as follows:

"The conductor to be grounded on a multi-phase system having one phase grounded shall be the identified conductor." (See rule for exact wording).

It is also significant to note that Section 2514 (250-5) would also recognize the grounding of one phase of a 3-phase, 3-wire, 440-volt delta. It appears obvious, in view of the foregoing, that the utility recommendation for grounding the 240-volt delta, not only satisfies code requirements, but also satisfies a code recommendation. There is no question in this respect, and I know of many installations in New York State where old 240-volt delta services have been grounded as shown on your diagram. Before grounding an old installation, it is important that any accidental ground be cleared before making the fixed grounded connection. Field experience indicates that many old ungrounded systems are grounded accidentally, and have been the cause of fire and personal injuries. While the safeguards provided by a grounded delta system are significant, it is important to note the hazard which results when the operating coil of a 3-phase magnetic starter is connected to the grounded phase. Under such circumstances, it would be possible for a ground fault to occur in the control circuit and not be noticed until the push-button is operated. The resultant short-circuit would be hazardous. This however could be avoided when the operating coil is not connected to the grounded conductor. Details with respect to control circuits are covered in a comprehensive article which appeared in the May 1957 edition of our publication.

According to the provisions of Section 2409, (240-12) no overcurrent device shall be placed in any permanently grounded conductor, except when the device simultaneously opens all conductors of the circuit. As a result the elimination of the fuses in the grounded conductors, as shown on your diagram, is required by the code. The main circuit breaker could have overcurrent protection in the grounded conductor since this device simultaneously opens all conductors of the circuit. This extra overcurrent device, however, is not required on either a new or an old installation. —B.A.McD.—11/59/6

Wiring Exhibit Building

Q. *Give wiring method required for a building of steel construction with concrete floors containing 18,000 sq ft floor area where such building is to be used as an exhibit building for a county fair.—C.W.S.*

A. It is my opinion that the wiring method would be as is required by Section 5211 (520-4), National Electrical Code, and I quote in part:

"The wiring method shall be metal raceways or type MI cable."

My basis for this interpretation is based on Section 5201 (520-1) and certainly a building containing 18,000 sq ft floor area and used as an exhibit building would be classed under this Section as a place used for public assembly.—R.E.W.

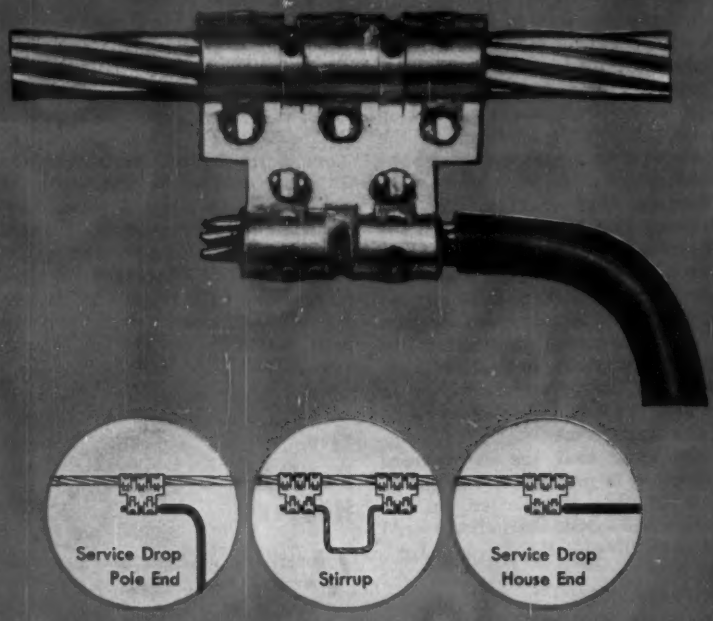
Editor's Note: Section 2001 of the 1958 Building Exits Code (NFPA) classifies an exhibition hall as an assembly building. Section 1102 of the same code provides a figure of 15 sq ft per person gross calculation for assembly occupancies, except areas having theatre or auditorium seating, in which case these areas are computed on the basis of 6 sq ft per person. Using the minimum figure of 15 sq ft per person, the population would be 18,000 ÷ 15 = 1200 persons.—J.H.W.—11/59/7

Transformer Disconnects

Q. *Disconnect and overcurrent protection for a feeder is located 200 ft from the transformer it supplies. Should an additional disconnect be installed at the transformer to satisfy Article 4511?—C. T.*

A. Section 4511 does not seem to have any connection with this problem. This section provides

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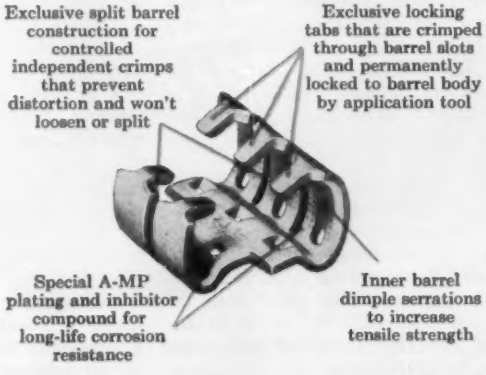
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for the location of the transformers and the transformer vaults and has nothing to do with the disconnecting means.

Actually there is no definite rule for disconnecting means for transformers. By inference and collateral requirements of other rules in the code, since overcurrent protection is required for transformers, the disconnecting means must also be installed.

Section 4512 (Section 450-3 in proposed 1959 Code) sets forth the requirements for the transformer overcurrent protection. No where in this section is there definitely set forth the distance or exact location of this overcurrent protection. In a general way this protection is required in the primary side, or in the primary side and secondary side of the transformer.

Assuming that the overcurrent protection is proper for the conditions of this installation, in my opinion the second disconnect would not be required.—B.Z.S.—11/59/8

Ground Continuity Through Bonding Locknuts

Q. *Do grounding type locknuts satisfy the provisions of Section 2572 of the N. E. Code?—L.E.F.*

A. For the convenience of our readers, the provisions of Section 2572 (250-72, 1959 Code) concerns the electrical continuity at service equipment. One of the methods recognized is covered by Section 2572-e (250-72e) which reads as follows:

"Other devices (not locknuts and bushings) approved for the purpose."

Since the word "approved" is defined in Article 100 as "Acceptable to the authority enforcing the Code," it becomes obvious that the status of grounding type locknuts with respect to the provisions of Section 2572 (250-72) must be decided by the electrical inspector who is responsible for enforcing the rules of the code. Most inspectors depend upon the services rendered by Underwriters' Laboratories when making such decisions. On the basis of UL listings, pages 137-142 of the 1959 Electrical Construction Materials List, we find several bonding and grounding devices which have been considered as providing the continuity required by Section 2572 (250-72). As an example, one manufacturer has "bonding locknuts" listed as follows: "Bonding locknuts for use with bushings to bond ½ to 4-in. rigid conduit to boxes, cabinets, or other enclosures, only when locknut is exposed." While I believe that such a UL listed locknut satisfies the provisions of Section 2572 (250-72), the approval of same, for such use, rests with the authority enforcing the code. In the case in question, I would first determine if the product is listed by UL. I would then refer to the manufacturer's literature for specific advice with respect to its use. I would then consult with the pertinent authority enforcing the code. —B.A.McD.—11/59/9

Portable Electric Heaters

Q. *When portable 230-volt electric heaters are to be installed, is it always advisable or required that such heaters be provided with 3-wire cords and 3-contact receptacles—2 wires and 2-contact points for the ungrounded conductors, the other wire and contact point for grounding the frame of the electric heater?—L.A.D.*

A. The above question is covered by Sections 2545 (250-45) and 4238 (422-12) of the 1956 (1959) National Electrical Code and Section 4238 (422-12) reads as follows with a fine print note:

"GROUNDING. Metal frames of portable and stationary electrically-heated appliances, operating on circuits above 150 volts to ground, shall be grounded in the manner specified in Article 250; provided, however, that where this is impracticable, grounding may be omitted by special permission, in which case the frames shall be permanently and effectively insulated from the ground."

(Fine print note): "It is recommended that the frames be grounded in all cases. For methods of grounding frames of electric ranges and clothes dryers, see sections 2557 (250-57) and 2560 (250-60)."

Although the fine print note recommends that frames be grounded in all cases, there is certainly a difference of opinion regarding this matter and as an example to emphasize the point that a hazard can be created by the grounding of the frame of a portable heater, the following hypothetical case is given:

A portable 230-volt electric heater with the frame grounded according to the recommendation of 4238 (422-12) is placed in a building or room with wood floors and not in reach of conductive material. A floor lamp or other piece of electrical equipment operating at 115 volts is placed near the electric heater. The frame of the floor lamp or piece of electric equipment becomes energized due to the ungrounded conductor coming in contact with the metal frame of the 115-volt equipment. A person making contact between the 115-volt piece of equipment and the grounded 230-volt heater will become a conductor and can receive fatal shock and for this reason it is the writer's opinion that each installation should be considered as to its individual application, location, etc. — R.E.W. — 11/59/10

Identified Conductor—Natural Gray

Q. *In our work on construction of electrical work, we ordered from our supplier four coils of every color of TW wire that they had. In the lot there were four coils of dark gray so dark that the black writing on it was hard to read. How serious a code violation would it be if this wire was used as a circuit conductor? Section 2006 says white or natural gray for grounded or neutral conductors. Have always used white for natural except once when we got a coil of wire marked natural gray, which was no more than a dirty white in color.*—M.H.

A. I do not believe that the dark gray covered conductor described in your question should be used as a circuit conductor. When it is difficult to distinguish between a black covered conductor, and a dark gray conductor, errors are likely to occur. At the time of installations such errors may not occur since you are familiar with the coloring. Later on, when additional wiring or equipment is installed, by some other electrician, the polarity of the circuit, or the equipment served may be reversed and this could be a serious error.

As an example, the grounded conductor of a circuit must be connected to the screw-shell of a socket, and when not so connected a serious hazard results. Visualize a house-

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holder on a stepladder replacing a lamp in a socket whose screw-shell is live. With one hand on the grounded stem of the fixture, and the other hand inserting the lamp, it is quite possible that he or she will receive a shock and be thrown from the ladder. This example is not hypothetical. The case cited actually occurred, and when such an accident happens all parties concerned with the installation find themselves in a difficult position to prove that they have not been negligent. The inspector, the electrician, the dealer and the manufacturer are involved, and I don't believe any of them desire to gamble on an accident.—B.A.McD.—11/59/11

Fixture Conductor Insulation

Q. *On a 3-phase, 4-wire, 277/480-volt grounded neutral system is it not permissable to use 300-volt AF fixture wire in fluorescent fixtures?*

The voltage to ground (277 volts) is adequately insulated by the 300-volt insulation. If 2-phase wires are adjacent to each other and each is insulated for 300 volts, the effective insulation between phases is 600 volts. This should adequately insulate the 480 potential existing between these two phase wires.

Are the conclusions as drawn above correct?—D.H.T.

A. The provisions of Section 4143 (410-19, 1959 Code), which concerns the insulation of fixture conductors, reads in part as follows: "Fixtures shall be wired with conductors suitable for the current, voltage, and temperature to which the conductors will be subjected."

According to the provisions of Section 1105 (110-5), voltages are described as follows: "Throughout this code the voltages considered shall be that at which the circuit operates."

Under Definitions, Voltage (of a circuit) is defined as follows: "The greatest effective difference of potential between any two conductors of the circuit concerned." The provisions of Section 3011 (300-3) reads, in part, as follows: "Conductors of light and power systems of 600 volts or less may occupy the same enclosure without regard to whether the individual circuits are alternating current or direct-current, only if all conductors are insulated for the maximum voltage of any conductor within the enclosure."

In the case under discussion, we have a 3-phase 277/480-volt branch circuit which serves fluorescent fixtures operating at 277 volts to ground. It appears however that the fixtures are used as raceways, as recognized by Section 4150, and the branch circuit conductors operating at 480 volts between phases are in contact with the 300-volt fixture conductors. In fact, your question indicates that two of the fixture conductors are adjacent to one another and the potential between the conductors is 480 volts. Under such circumstances it appears to me that the provisions of Sections 4143 (410-19) and 3011 (300-3) are violated.

While the voltage to ground is satisfied with 300-volt insulation, I do not believe that your logic with respect to effective insulation between the 2-phase conductors is correct. If it were, there would be no occasion to use 600-volt insulation on branch circuit conductors. They could be insulated at 300 volts. —B.A.McD.—11/59/12



CALIFORNIANS attending IAEL's 24th annual conference in San Diego included Glen L. Logan, managing director, Electric League of Los Angeles; Bert W. Reynolds, manager of the Northern Cal. Electrical Bureau, San Francisco; Harry M. O'Laughlin, sec-treas., Sacramento Valley Electric League, and Victor W. Hartley, managing director for the Pacific Coast Electrical Association.

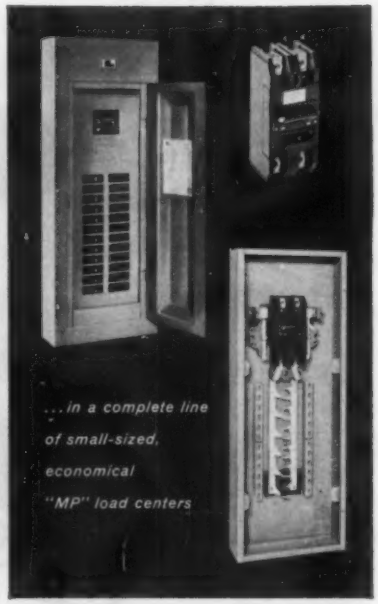


APPLIANCE SERVICING, was analysed critically by Keith L. Chamblin, California Electric Service Co., Los Angeles, and John F. Camp, Sr., Camp Electric Co., Memphis, Tenn., at IAEL's meeting in San Diego.

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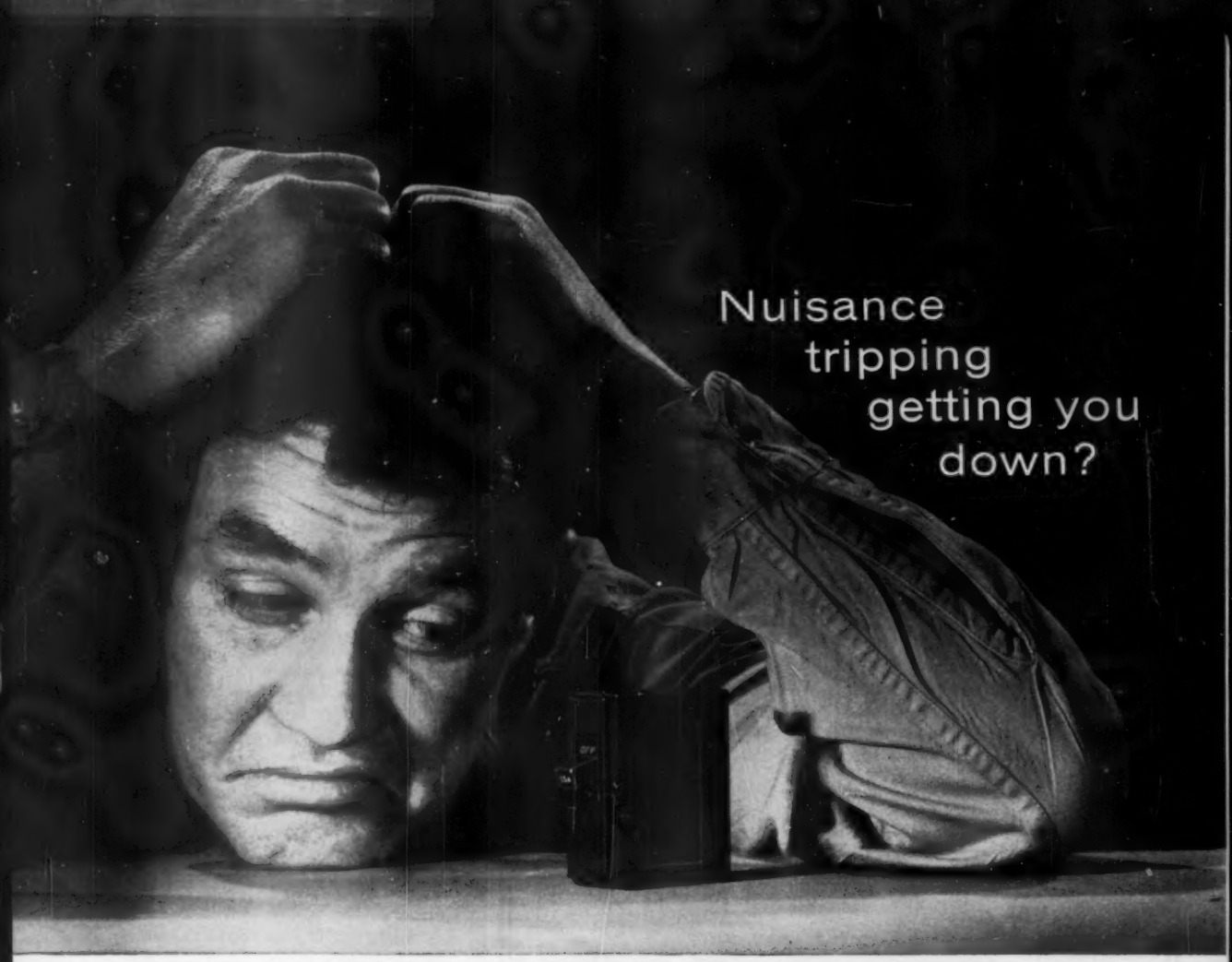
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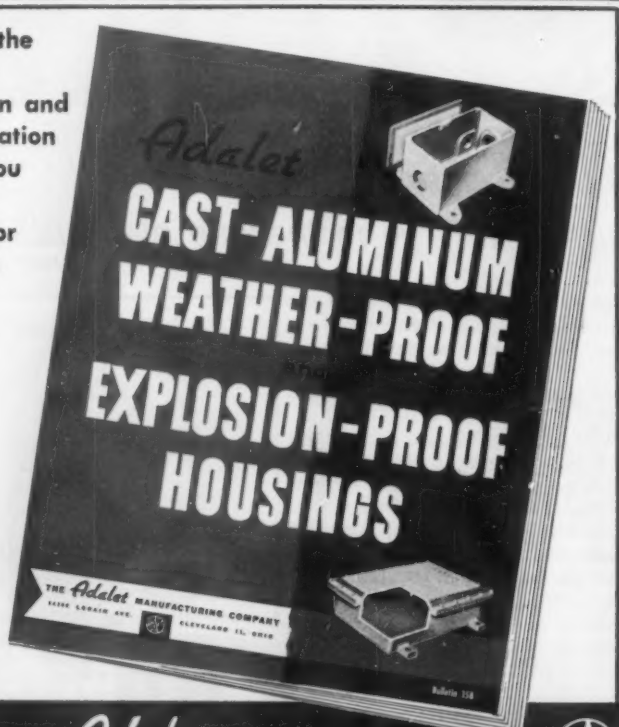
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CARE IN USE OF METERS

[FROM PAGE 142]

excess of nameplate reading. After a phone discussion with the service shop, the electrician is asked to check the line voltage. He phones back that the voltage is 223 volts.

Since this is in New York City where the network voltage seldom exceeds 210, because of the grounded Y point for neutral, the service shop sends up a man with a voltmeter to check the voltage. He discovers 192 volts—the reason for motor heating troubles.

The electrician had used a rectifier type meter which normally, when new, is accurate to plus or minus 3% to 5%. It had not been checked since he had bought it "5 years ago." *Moral: Use a meter of known accuracy.*

13 A 5-hp, 3-phase, 208-volt, 1800-rpm induction motor is sent to a shop for rewinding. The shop tests the motor and is unable to find the reason why it was brought in. It seems to run all right, "megs" properly (over 5 megs), has balanced amperes per leg. It is taken apart, and usual examination indicates no reason for a complaint. They are about to place it on a dynamometer for a torque test when a decision is made to call the owner of the motor. The answer is —"the motor is grounded." Again a megohmmeter is used, and the new reading is noticed—over 5 meg ohms—more than enough for this type of equipment. Again a telephone call; and this time upon inquiry, it is found that a clamp-on type voltmeter was used. (This is an ac rectifier movement) "How was it tested?" "By leaving a live leg on one side of the meter and using the other lead of the meter to touch motor leads." "And what did you get as a reading?" "About 190 volts with 208 volts applied."

The motor was returned as "OK" and the maintenance man on the job was told to use a megohmmeter or dc for ground testing thereafter.

A rectifier meter usually requires very little current to operate it—about 50 or 100 microamps (50 or 100 millionths of an ampere). The motor acts as a *capacitor* and dependent on the type of insulation used for the windings, it will always pass more than a few micro amps of current which in turn will usually drive a sensitive rectifier meter to full voltage of line.

DEALING WITH ARCHITECTS AND ENGINEERS

[FROM PAGE 119]

no guaranteed price, in either, to cover cost of additions and changes that the owner might wish to make later.

In spite of all that can be done, owners will ask for changes and additions after the main project is under construction. And they will be displeased with the resultant costs of same. Something must be done to keep overall building costs "in line" and maintain the owner's confidence. Along these lines, the following "must" suggestions are offered:

Architects must—

1. Make a special effort to get complete information from the owner.

2. Impress owners with the danger of excess costs if pertinent information is not forthcoming before contracts are let.

Each trade must—

1. Make every effort to note any shortcomings in plans or specs and consider possible future needs of the owner.

2. Guarantee a complete job for the contract price.

3. Be prepared to absorb the cost of some minor changes and additions.

With a good, competent architect, capable contractors, and the above suggested practices, the owner will be well protected.

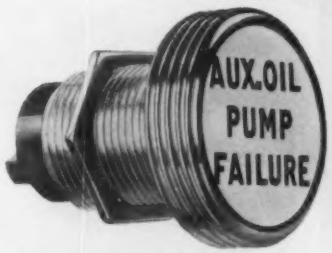
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The contractor's prime business with architects or engineers is selling electrical installations. If he is to maintain or improve business good will, he must convincingly establish that his quoted price is right. He has the knowledge and data to do this. He should use this information to advantage—his, the architect's or engineer's, and the owner's.

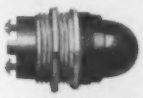
It will be found that by following these suggestions, contractors will benefit in their future business relations with architects and engineers. These regular customers do not forget past courtesies.

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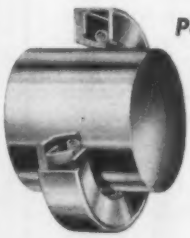
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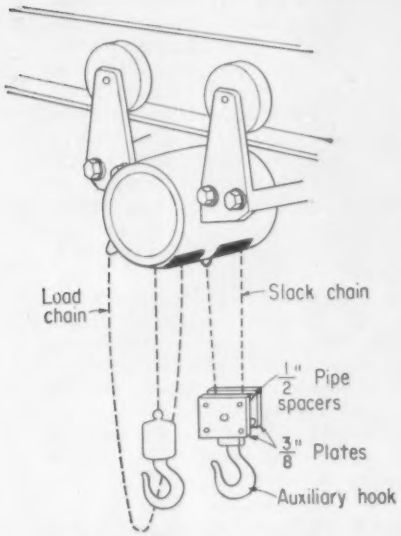
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An auxiliary sheave hook arrangement added to an existing hoist can save time in loading motors on trucks or moving batteries to or from racks or lift trucks by eliminating time wasted in running the hook back after each hoisting operation.

As shown here, the bolt at the end of the slack chain may be cut and reeved through a block fabricated of two ⅜-in. plates held together by bolts through ½-in. pipe spacers and using a 4-in. sheave between the plates. Any available hook may be suspended from the block.

With this arrangement, the auxiliary hook is down, ready for the next load, when the main lift hook has been raised with its load.

Grits Blast Booth For Large Motors

Frequently motors come into a shop needing nothing more than a thorough cleaning to put them back in efficient operating condition. Layers of oil-impregnated dirt, dust and grime build up on coil ends, clog air passages in the motor frame, and generally impede adequate ventilation when the motor is running. Remove this accumulation without damaging coil insulation and the problem is solved.

Corn grits blasting is one method of "dry cleaning" wound stators and rotors without the danger of insulation damage. In this process, a high-velocity stream of ground corn cob particles is directed on the work. The grits have sufficient bulk to do an effective cleaning job, yet are soft enough to be non-abrasive.

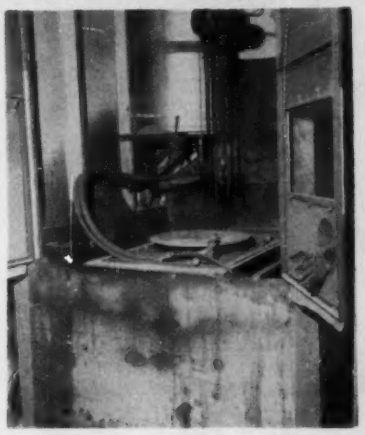
Marion Electric Motor Service, Inc., Marion, Ohio, uses this technique extensively in its operations. Corn grits blasting is concentrated in a relatively small shop area where shop foreman R. L. Patrick and his mechanics designed and built two booths. One (see pg. 125 EC&M, September 1959) is for small motor cleaning. The other is for large motor work. Both incorporate a recirculating duct system for grits recovery.

The large sheet metal booth is about 10 ft high, 5 ft wide, and 6½ ft deep with hinged double-doors on the front opening some 40 in. above floor level. Each door has a rubber-protected access handhole and eye-level glass viewing window. A monorail electric hoist carries work into and out of the enclosure.

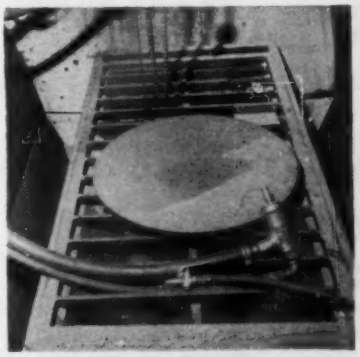
Bottom of the booth consists of a large metal hopper which collects the corn grits and feeds them into a metal duct connected to a centrifugal blower. This blower forces the recovered grits through a return duct to the top of a grits storage tank inside the enclosure. Tank capacity is about 240 lbs (six 40-lb sacks) of No. 162 coarse-grind corn cobs. An exhaust fan in the back of the booth removes dirt and dust during the cleaning operation.



GRITS BLASTING of large motors is done in this metal booth. Mechanic watches through door windows as he rotates work and directs grits stream in illuminated enclosure.



INTERIOR OF BOOTH has corn grits storage tank, monorail electric hoist, hose connections, exhaust fan and grid-supported turntable. Hopper at base collects recovered grits for reuse.



STEEL TURNTABLE rests on bar grid bridging booth hopper. Grid can be lifted out to clean wire mesh which screens dirt particles from grits cleaning residue.

A dual hose, one from the bottom of the grits tank and the other from a compressed air connection, terminates in a single nozzle which produces the high-velocity grits stream. A valve in the air hose controls blast pressure. A separate air hose with lever valve nozzle is used to blow out any grits particles that may have been caught in the motor coils or frame.

The top of the booth hopper is bridged by a rectangular angle-iron frame which supports a parallel-bar grid on top of a wire-mesh screen. Both grid and screen are removable for cleaning. Another wire-mesh section at the hopper base provides additional screening of the recovered grits. Mechanics



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BLOWER OUTSIDE booth pulls recovered grits from booth hopper, forces them through return duct to storage tank in booth.

rely on visual inspection and "feel" of the grits to indicate when an existing batch should be discarded and a new supply used.

Stators are placed on a 24-in.-diameter, ½-in. steel-plate turntable, ball-bearing mounted to a sturdy flat steel base. Turntable can be placed anywhere on the supporting grid. The operator, with his arms through the access holes in the closed doors, turns the work with one hand and directs the grits stream with the other. A more recent addition to the grits blast booth equipment is a roller assembly for supporting and rotating rotors.



FOUR DECADES OF SERVICE in the motor repair business is the record of Carl Hermanson, owner of the Electric Motor Repair Company in Bridgeport, Conn. In this field since 1917, Mr. Hermanson still serves many of his original customers, many of whom still insist upon "the boss" supervising their work personally. These indications of customer satisfaction and confidence are what Carl refers to as "intangible recompense" for these many years of industrial service.

Refrigerator Converted To Baking Oven

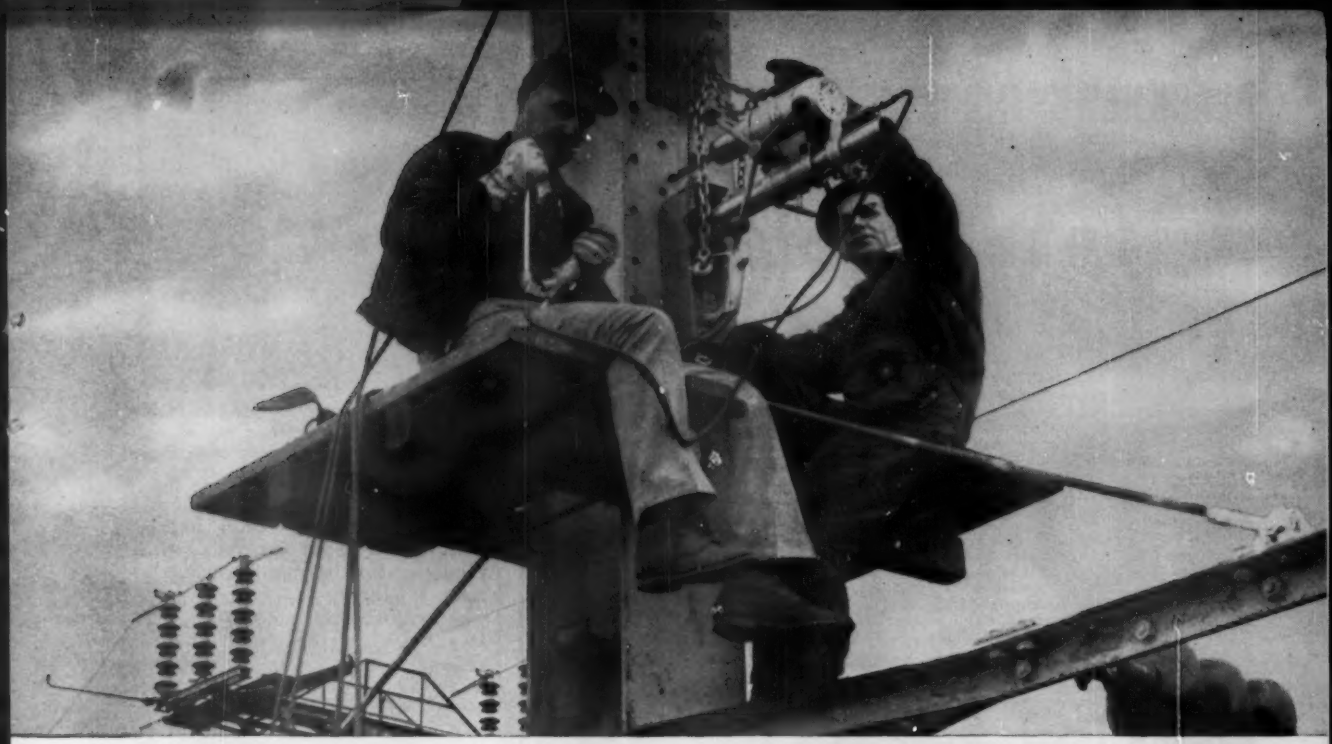
A discarded refrigerator is used as a baking oven in the shop of the Buckner Electric Motor Service Company, Kokomo, Ind. The unit, measuring 5 ft high by 2 ft square, is suitable for handling all types of small motors. As indicated in the accompanying photographs, the converted refrigerator is minus its motor and compressor. Otherwise the unit is used in its original form, except for the following modifications:

Two 500-watt strip heaters are mounted to the inside back of the refrigerator. Temperature control is maintained by a temperature regulator taken off an old electric stove. The regulator, mounted on the right side of the refrigerator at eye height, has a temperature range of 0 to 600 degrees. A manually set, 110-volt, 12-hour time clock mounted directly above and connected to the temperature reg-



INSIDE AND OUTSIDE VIEW of discarded refrigerator that was converted to a baking oven for all types of small motors. Old refrigerators similar to the one pictured here generally can be purchased for $10 or less. Strip heaters and other materials needed for the conversion are also inexpensive.





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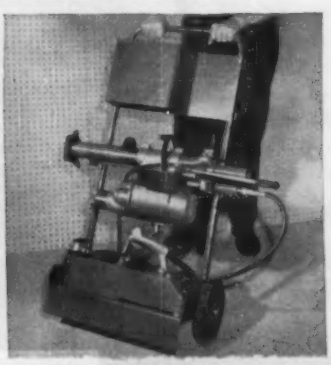
B&D 1¼" MAGNETIC DRILL PRESS works high overhead upside down; enables maintenance man to get into tight spots easily, rapidly.

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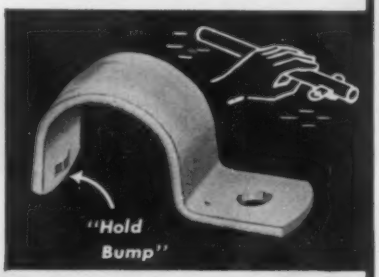
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easier to sell because it's easier to use

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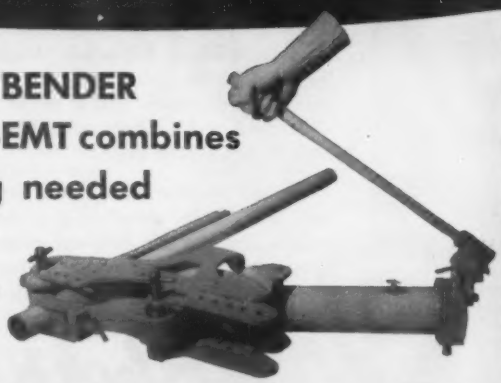


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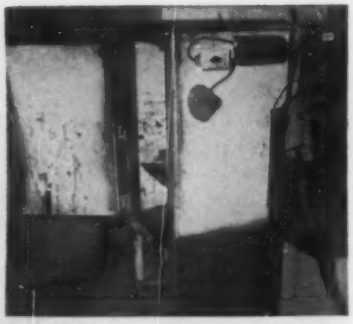
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CONTROLS mounted to the side of old refrigerator converted into a baking oven for small motors are temperature regulator that was formerly part of an electric stove and a manually set, 110-volt, 12-hour time clock.

ulator governs the amount of time required for baking various size motors.

A manually adjustable 3-in. vent is installed in the top of the old refrigerator. A 1-in. hole bored in the bottom of the box also provides ventilation, while allowing the excess drippings to run into a tray placed in the space that originally housed the refrigerator's motor and compressor. On the inside of the box, a conventional metal rack formerly used for holding perishable goods, can be adjusted to different heights to support various size motors during the baking process.

Landon Hudson and Ralph McCauley, partners in the firm, are more than pleased with the operation of the unit to date. They pointed out that the cost of converting the refrigerator to a baking oven was very economical; generally old refrigerators can be purchased for $10 or less, and used temperature regulators are inexpensive, as are the manual set timers and strip heaters.



TRAINING a new employee in the shop of the Lange Electric Co., Baltimore, Md., is Mitchel Frye (right), group leader for that motor service organization. Among Lange's employees are several disabled veterans who merit praise for their workmanship and loyalty to the company.





Wrenches

Sanders

SCHOOL LIGHTING

[FROM PAGE 123]

at a time be compared and that the selection of the systems to be compared be based as nearly as possible on some single objective. For example, systems 1 and 2 permit a good direct comparison of incandescent vs. fluorescent lighting. The economic advantage of reducing the number of outlets is shown by systems 2, 3, and 4 since all of these systems utilize the same type of equipment. Attention is also called to the fact that systems No. 4, 7, 12, 15, and 17 are the only ones that provide the 70 footcandles recommended for reading longhand writing. The relative economy of 4-lamp vs. 2-lamp is shown by systems 4 and 5. The 4-lamp installation has a higher total annual cost but, because it is providing nearly twice as much illumination, its cost per footcandle is 19% lower than that of the 2-lamp installation.

Other possible comparisons are systems 4 and 8 to show the relative cost of direct-indirect vs. semi-indirect lighting, or systems 3 and 15 for a direct comparison of rapid-start and slimline lamps with all other things being directly comparable. Many other similar analyses can be made.

The selection of the lighting system which best meets the requirements of the given school depends upon many factors, of which cost is only one. Initial investment is a poor and unreliable means of comparing costs, for it does not take into account extreme differences in operating costs. Low or moderate cost installations that do not provide adequate illumination or that create uncomfortable seeing conditions are poor investments since only slightly more money (and sometimes less) is required for systems that satisfy the seeing requirements.

Proposed lighting layouts other than the 17 typical examples shown in Table II can be easily analyzed and compared by making the computations indicated in the Table, taking care to use the appropriate energy rate and estimated annual burning hours. Such analysis and comparison should prove helpful in determining true relative economics providing, of course, that the proposed system is adequate from the quantity and quality of light standpoint.

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Two female threaded hubs at precise 90° angle. Rigid, domed covers with full neoprene gaskets. Sizes ½" to 2".



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Two hubs at perfect 90° angle, one female and one male threaded. Rigid, domed covers with full neoprene gaskets. Lock nut included. Sizes ½" to 2".

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QUICK, EASY-TO-USE



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Make big loop of wires and pull thru other side of elbow and conduit. No obstructions inside elbow—gives smooth travel.



Pull wires taut from other end of system — cover attaches quickly with big screws, opens easily anytime.

MADE BETTER FOR YOUR NEEDS

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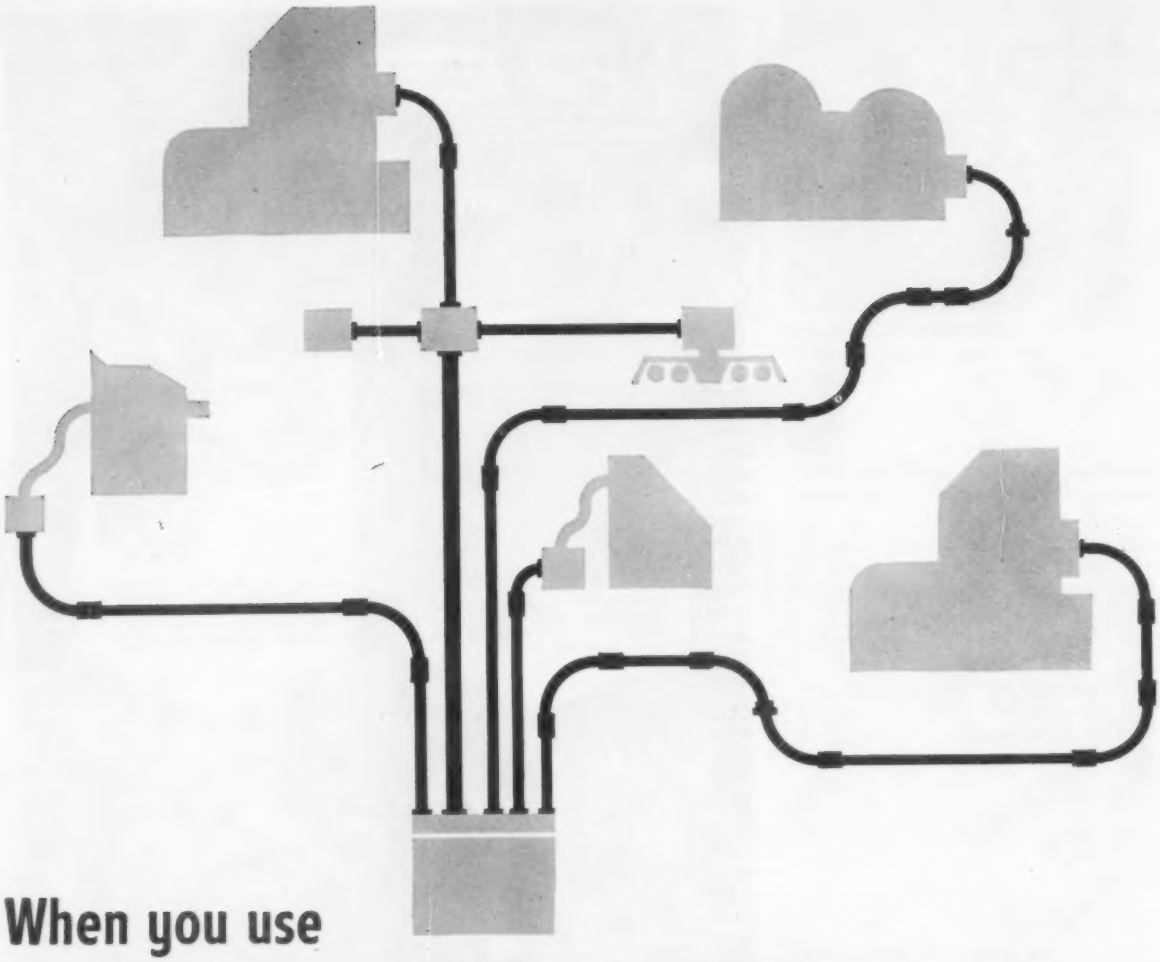
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Electrical Inspectors Discuss '59 Code

Problems and trends in code requirements for electrical installations highlight IAEI section meetings.

Enthusiastic discussion and debate on changes and additions in the 1959 National Electrical Code were features of the eastern, western, northwestern and southwestern sections of the International Association of Electrical Inspectors. The following is a summary of the interesting highlights of these meetings.

Eastern Section

The eastern section of the International Association of Electrical Inspectors held its 35th annual meeting in the Essex and Sussex Hotel, Spring Lake, N. J., September 14 through 17. A varied and interesting program of technical sessions included formal presentations by industry authorities and the ever-popular "code clinic" discussion periods. Another highlight of this convention was the exposition of electrical products by leading manufacturers.

At this meeting, G. J. Bostley, chief inspector for the New York Board of Fire Underwriters in Albany, N. Y., was elected president of the eastern section for 1960, succeeding Clifton R. Clark, Avon, Conn. Other officers elected include: J. D. O'Connell, New York City, first vice president; J. W. Mannix, Belmont, Mass., second vice president; C. L. Kelly, Sr., Bridgeport, Conn., third vice president; R. L. Lloyd, Washington, D. C., fourth vice president; and R. A. Jutstrom, South Weymouth, Mass., secretary-treasurer. A new chapter for western Pennsylvania was accepted into the Eastern Section, as presented by Sterrett L. Clark, chief electrical inspector, Pittsburgh, Pa.



NEW YORK CITY was well represented by inspection authorities and electrical code people at the 35th annual eastern meeting of IAEI at Spring Lake, N. J., including (L-R): W. A. Doyle, supervising chief inspector for New York City, and Felice Marcellino, chairman of the advisory board, DWSGE.

A wide range of topics were covered in the formal addresses at the technical sessions, as follows:

EDUCATION OF ELECTRICAL INSPECTORS—B. A. McDonald, consulting editor of *Electrical Construction and Maintenance*, gave a talk on "Plans for Furthering the Education of Electrical Inspectors." Noting that other segments of the electrical industry provide continuous educational programs for their personnel, Mr. McDonald stated that IAEI is not satisfied with existing means of meeting the growing educational needs of the inspection industry. The technology of all phases of electrical work is constantly expanding in complexity and extent, and the electrical inspector must keep up with all such expansion to properly discharge his responsibilities. Education is actually more important to him than to other industry people who can specialize in one or only a few phases of electrical work. "He is the authority who has the responsibility for checking wiring designs by accredited Professional Engineers regardless of the fact that, generally speaking, he has no professional standing," Mr. McDonald pointed out. This paradox can be solved by upgrading the status of inspectors through education, publicity and professional recognition. After reviewing past efforts to establish a suitable educational program, Mr. McDonald advised the members that he has been appointed chairman of a committee to study the problem and to advise on the initiation of an educational program.



INCOMING PRESIDENT of the eastern section IAEI. G. I. Bostley (right), Albany, N. Y., was elected at the 35th annual section meeting, at Spring Lake, N. J., to succeed C. R. Clark (left), Avon, Conn., who was president for 1959.

PROTECTION AGAINST SHORT CIRCUITS—A number of outstanding industry authorities delivered addresses which made up a vigorous analysis of short-circuit protection. The talks went into the theory of protection and covered application engineering on modern protective devices.

Kenneth Swain of the Chase-Shawmut Fuse Company discussed short-circuit analysis and sizing of fuses for interrupting requirements of specific circuits. He began by pointing out that the code requires that "Devices intended to break current shall have an interrupting capacity sufficient for the voltage employed and for the current which must be interrupted." This, he said, places final responsibility for effective short-circuit protection with the electrical inspector. He then outlined a procedure by which the inspector can effectively and readily enforce proper protection. In any case, the only course open to the inspector is to determine available fault current and then check the adequacy of the protective device in question.

"High-Capacity Interrupting and Current-Limiting Fuses and their Applications" were described by Martin Smith, Bussmann Mfg. Company. He pointed up the difference in construction and application advantages between the high IC fuse and the current-limiting fuse.

Other presentations on overcur-



FRANK STETKA, field engineer, NFPA, Chicago, Ill., explained a number of the new NEC rules to the Eastern Section IAEI meeting.



S. O. SCHWARTZ, Senior Engineer for the Brooklyn Union Gas Co., attended the Eastern Section IAEI meeting in Spring Lake, N. J.



LEADING A DELEGATION from the Westchester Chapter was T. M. Mackie, chief electrical inspector of the New York Board of Fire Underwriters.

rent protection were: "Fault Currents and Protective Devices in Low-Voltage Power Systems," by H. R. Reed, General Electric; and "Coordination of Fuses and Circuit Breakers," by W. H. Edmonds, ITE Circuit Breaker Company.

STEEL AND ALUMINUM CONDUIT—An interesting part of the lecture sessions was the discussion of the relative merits of steel and aluminum conduit. Actually there were two separate presentations—one by R. S. Keith of Kaiser Aluminum, on aluminum conduit; and one by C. T. Flachbarth of Walker Bros., on steel conduit. A lively question-and-answer session followed, and much interest was expressed in the installation of aluminum conduit.

ELECTRIC HEATING—R. C. Cressman of General Electric spoke on "What's Ahead for Electric Heating." He pointed up the history of electric heating, citing its particularly fast rate of growth through recent years. Mr. Cressman also described the many advantages of modern residential electric space heating — convenience, comfort, cleanliness, initial cost of system, etc. He also covered such subjects as: types of resistance heating equipment; heat pumps; insulation; heat-loss calculations; and typical heating costs. With an increasing number of electrical utilities experiencing summer peaks and seeking compensating winter loads, the future looks particularly promising for electric heat, he concluded.

Other interesting discussions on the program included: "Fire Protection and Alarm Systems," L. T. Chandler, Edwards Company; "Emergency Generators—Application and Installation," T. J. Brown, Jr., Fairbanks, Morse and Company; and "A Survey on Overload Protection for Three-Phase Motors —Two and Three Overcurrent Devices," J. A. Cortelli, Clark Controller Company.

Western Section

The 2100-member Western Section, International Association of Electrical Inspectors, held its 55th Annual Meeting at Hotel Schroeder, Milwaukee, Wis., Oct. 5-7. More than 600 registrants participated in the formal and forum sessions; viewed the exhibits of more than 30 electrical equipment manufacturers; returned to their homes in the 19-state area with enriched technical knowledge and a much broader concept of the position and responsibility of the electrical inspector in this dynamic, expanding electrical industry.

Part of the formal program was devoted to the "lot" or "position" of the electrical inspector. He lacks recognition by the general public and is in need of better public relations, according to international president Rene LaBelle, Montreal, Canada. To gain the understanding



TECHNICAL DISCUSSIONS were the order of the day at the recent eastern section meeting of IAEI at Spring Lake, N. J., including this one among (L-R): A. Silvestri, electrical consultant, Utica, N. Y.; R. D. Cranson, western N. Y. supervisor, N. Y. Board of Fire Underwriters, Buffalo, N. Y.; and Daniel Boone, Federal Pacific Electric, Newark, N. J.



ELECTRICAL INSPECTION was the main topic of conversation for members attending the 35th annual meeting of the eastern section IAEI, at Spring Lake, N. J., including (L-R): G. Ludwig, Dept. of Water Supply, Gas and Electricity, N. Y. C.; J. Dillon, also of the DWSGE, Staten Island, N. Y., and James A. Goodman, Con Edison, New York City.



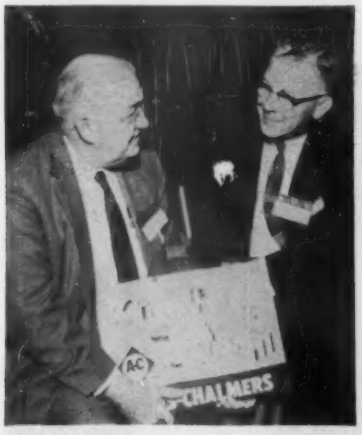
STERRETT L. CLARK, Chief Electrical Wiring Inspector of Pittsburgh, Pa., is one of the founders of the newly formed "Western Pennsylvania Chapter" of the Eastern Section IAEI. Mr. Clark petitioned the Section for membership of the new chapter, and they were enthusiastically welcomed into the Eastern Section by the delegates in attendance.



NEW OFFICERS of the Western Section, IAEI, are: (L to R) secretary-treasurer—D. M. Lines, Topeka, Kansas; 1st vice president—W. P. Hogan, Jr., Chicago, Ill.; president—W. E. Stewart, St. Louis, Mo.; 2nd vice president—H. B. Love, Detroit, Mich.

and respect of the public, inspectors first must gain their confidence, he warned. One way to do this was noted by L. S. Crain, deputy state fire marshal, Lincoln, Neb. Tell the homeowner "why" things are wrong, not merely that they are wrong, he advised. Another broad scale method was outlined by A. H. Welklin, Ft. Wayne, IAEI Public Relations Committee chairman. Using examples of his own program, he showed how the local press, radio and TV can become effective PR safety media. Section PR chairman, Gordon Malby, Evanston, Ill., recounted his own experience along these lines. Every inspector should develop a public relations program and use a camera, they concluded.

George Andrae, Milwaukee electrical contractor and code expert, sees the need for full-time, qualified electrical inspectors in the rapidly growing suburban and rural areas. Ten years' experience as a journeyman electrician is not enough qualification, he cautioned. An inspector candidate should have a high school



EARLY ARRIVALS for recent Western Section, IAEI, convention code session are electrical inspectors H. E. Krubsack, Marinette, Wis.; and L. E. Asmus, Appleton, Wis.

IT TAKES A SPECIALIST LIKE STROMBERG-CARLSON

to assure superior sound quality

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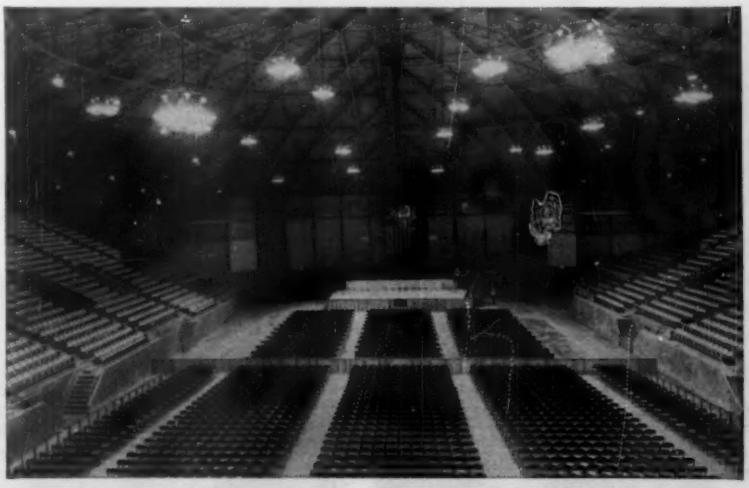
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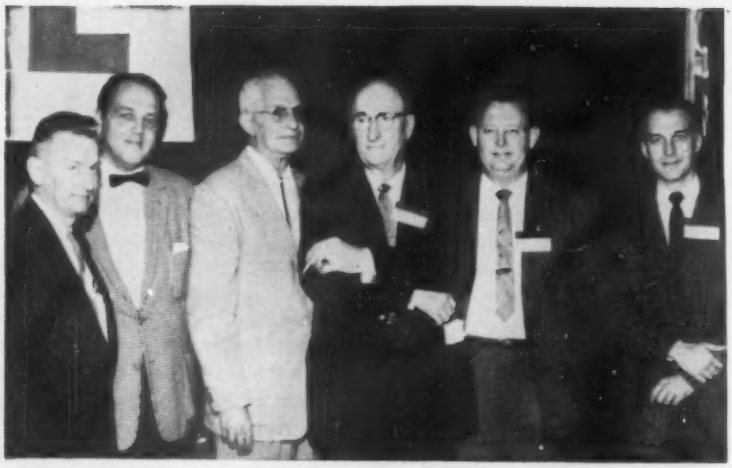


Brown County War Memorial Arena, Green Bay, Wisconsin.
Anderson Electric Service, Inc., Electrical Contractors.



"There is nothing finer than a Stromberg-Carlson"

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EXECUTIVE COMMITTEE of Western Section, IAEI, is composed of: (L to R) S. M. Sanford, St. Paul, Minn.; R. S. Davis, Detroit, Mich.; C. B. Tressel, Canton, Ohio; L. S. Crain, Lincoln, Neb.; E. E. Patterson, Oklahoma City, Okla.; R. B. Thomson, Kansas City, Mo.; and A. A. Sommer, Chicago, Ill. (not in photo).

diploma plus one or two years technical school training, good command of language, good appearance and a tactful approach. All in the electrical industry, including inspectors, must keep pace with newest developments by constant reading and study of technical and trade publications, he concluded. Among other things, speakers pointed up the generally inadequate staffs of electrical inspection departments and the relatively low compensation for personnel.

E. H. Herzberg, executive manager, Milwaukee Chapter, NECA, pointed up the contractors' stake in good code rules and inspection programs; noted that his organization employs a code consultant (retired Milwaukee City electrical inspector Grover E. Kruecke) for daily contractor consultation and periodic code classes.

Technical Sessions

The National Electrical Code establishes the basic ground rules of minimum electrical safety. Over and above that, electrical inspectors should have a technical background to supplement their decisions. Hence, every section meeting includes an agenda of pertinent technical papers. Among the subjects covered at the Milwaukee meeting were the following:

ALUMINUM AND THE CODE—Dixon Lewis, manager, conduit products, Rome Cable Div., Aluminum Company of America, reviewed application of aluminum conduit, cable and fittings within code limitations; emphasized some apparent conflicts. The 1959 Code has current-carrying tables for aluminum conductors and Article 110 permits substitution of aluminum for copper on a current-carrying basis. Yet, Articles 354 and 362 still limit the size of conductors in underfloor raceways and wireways to 500MCM. On a strict current-carrying basis, 750MCM aluminum should be permitted, he argued.

On the basis of recent tests, Underwriters' Laboratories says aluminum conduit can be installed in concrete without a protective coating because the alloy used is corrosion-resistant in concrete. Even in mixes containing 2% calcium chloride (by weight), aluminum will stand up, he added. All metal conduit, aluminum or steel, should have protective coatings when buried directly in earth.

Because of the alloy used (high copper content), aluminum fittings still must be coated when placed in concrete. Mr. Lewis suggested fitting manufacturers standardize on alloys of known composition and low copper content so this additional protective coating may be eliminated. Fear of appreciable galvanic action between aluminum conduit and steel fittings is unwarranted because aluminum, zinc and cadmium (protective coatings on steel) are so close together in



PROPOSED SURVEY on need for two or three overcurrent devices on 3-phase motor protection should resolve this controversial question, J. J. Mellon, Allen-Bradley Co. (representing NEMA) tells inspectors convening in Milwaukee.



PERTINENT TECHNICAL information on aluminum and its place in the electrical construction field is presented by Dixon Lewis, manager, conduit products, Rome Cable Division, Aluminum Co. of America, at Western Section convention.



FIRST MERIT public confidence, then you will gain their understanding and respect, international IAEI president Rene LaBelle, Montreal, Canada, tells electrical inspectors at recent Western Section, IAEI, annual meeting.



THERE'S THE ANSWER, points J. P. O'Brien, city electrical inspector, Eau Claire, Wis., as R. E. Poynor, city electrical inspector of Fort Smith, Ark., checks NEC following code session at Western Section, IAEI, meeting in Milwaukee.

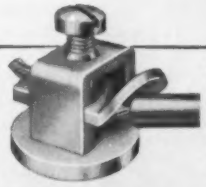
the galvanic series that they are mutually protective and should be considered as completely compatible instead of dissimilar, Lewis noted. The non-magnetic features of aluminum; lack of hysteresis loss; and low-resistance, low-impedance path to ground are "differences" between aluminum and steel that should have code recognition, Lewis believes.

FAULT CURRENT PROTECTION—The need for adequate short-circuit protection in electrical systems was emphasized by H. D. Reed, General Electric Company, in a dramatic film presentation of laboratory tests showing the hazards of short-circuit currents. Throughout his review of today's protective devices, including the fused circuit breaker combination, he pointed out that selection of adequate circuit protective equipment depends on the size of the load (for overcurrent protection) on a circuit and the kva rating of transformers and generators supplying the entire system (for short-circuit current interrupting capacity). Engineers and inspectors must keep this in mind when designing and checking an electrical system.

SAFETY IN ANESTHETIZING AREAS—Kent P. Stiner, Detroit, IAEI member of NFPA 56 Committee (Hospital Operating Rooms) since 1947, related more than a decade of progress in development of electrical safety regulations for anesthetizing locations. The program has gained national acceptance and we now must strive for refinement, universal enforcement and interpretation, and a continuation of the selling job being done by various electrical inspectors throughout the country. Stiner warned that these safety regulations can be effective only if all (not part) of the re-



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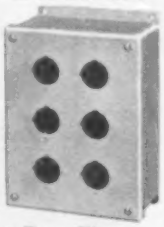
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REUNION IN Milwaukee finds Western Section, IAEI, past-president L. S. Crain, Lincoln, Neb., introducing honorary member Arthur Headstrom of Largo, Fla., who retired after 36 years as chief electrical inspector of Des Moines, Iowa.

quirements are followed; all persons and equipment are in electrical contact together; all hazardous area circuits are ungrounded and monitored by a detector (visual and audible); all permanent and portable equipment within 5 ft of the floor is approved for Class I Division 1 locations; equipment above the 5-ft level will not permit a hazard to enter the lower area; rules and regulations on maintenance and use of equipment and personnel are enforced.

3-PHASE MOTOR PROTECTION — Should two or three overcurrent units be required to protect 3-phase motors on systems with wye-delta or delta-wye connected transformers? The fine print note of Table 430-37 (1959 NEC) still leaves the decision to the inspecting authority. Code Panel 11 is still considering the question and wants more information from the field, revealed J. J. Mellon, Allen-Bradley Co., who presented a subject paper prepared by the Industrial Control Section of NEMA. To get the answers, a comprehensive, nonpartisan, questionnaire-survey, prepared and conducted by Underwriters' Laboratories, will be made among motor users, power companies, inspectors, electrical manufacturers, machinery manufacturers, refrigeration and air conditioning manufacturers and all other interested parties. Mellon urged wholehearted inspector cooperation in relating their field experiences in this respect.

ELECTRIC SPACE HEATING — T. J. Lanham, vice president, Engineering Sales Co., Inc., Ft. Wayne, Ind., told the assembled inspectors that electric home heating is an expanding field that will "knock the socks off the electrical industry." Tracing the upward curve from 10,000 electrically heated homes in 1950, he predicted some 2½ million a few years hence with about 300,000 in the midwest area. As for equipment, heating cable is most popular with new homes. While only 15% of new homes use baseboard electric heating, he sees a tremendous conversion market for these units in the 34 million homes built more than ten years ago. Lanham believes electric heating and insulation should be sold as a package deal. Heat pumps (with supplementary resistance units) will get a large part of the residential market and the warm air heating industry is coming out with electric furnaces, he noted.

Panel Sessions

Experting a panel discussion of the 1959 NEC were the following NFPA Electrical Code Correlating Committee members: Frank Stetka and Merwin Brandon, Chicago; O. K. Coleman, Lafayette, Ind.; H. H. Watson, Bridgeport, Conn.; and L. S. Inskip, Murray Hill, N. J.

New methods of calculating single-family dwelling loads to determine service size (examples in Chapter 9, NEC) were explained in detail. A few inspectors questioned the adequacy of the 40% demand applied to electric space heating in the calculations. Panel members revealed that while carefully screened test results from 1000 installations throughout the country indicated a 35% demand



EXCHANGING field experiences at recent western electrical inspectors meeting in Milwaukee are (L to R): M. W. Musick, Muskegon, Mich.; Fred Kobes, Holland, Mich.; and Nebraska Chapter, IAEI, first vice-chairman Tom Peabody of Hay Springs, Neb.



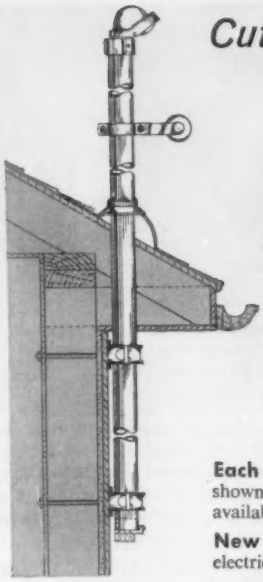
ELECTRIC HEATING and home insulation comprise a logical "package" sale, T. J. Lanham, Engineering Sales Co., Inc., Ft. Wayne, Inc., tells electrical inspectors while painting picture of bright home heating market at recent inspector convention in Milwaukee, Wis.

adequate, Code Panel 2 raised it to 40% for additional leeway. Additional reports revealed that comprehensive recording tests on all-electric homes showed maximum demand did not exceed the connected load of the space heating equipment alone.

Inspectors were again reminded that, by code definition, the word "approved" means acceptable to the authority enforcing the code—the electrical inspector. Also noted was the fact that, while the code does not specifically designate Underwriters' Laboratories as the accepted testing authority, UL approval on equipment is generally considered as a guide to inspectors.

A forum session on code field problems gave inspectors an opportunity to get answers to questions pertinent to their own operations. Panel members at this session were: W. P. Hogan, Jr., Chicago; H. B. Love, Detroit; Gordon Maltby, Evanston, Ill.; Charles Stasek, Cleveland; J. E. Fisher, Elkhart, Ind.; and H. A. Jaberg, Cincinnati, Ohio.

One major problem, posed by L. S. Crain, Lincoln, Neb., is the lack of any wiring standards for mobile trailer homes. This will be corrected Jan. 1, 1960, according to H. B. Love, Detroit, an IAEI member of a committee investigating this subject. At that time a set of mobile home wiring standards will become effective. These have been established and accepted by some 50% of mobile home manufacturers (representing 80% of total production). Included are requirements for a main 50-amp breaker or 60-amp fuse pull-out, plus four branch circuits; a 50-amp supply cord and



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FINAL CHECK of conference agenda is made by convention chairman G. E. Kruecke (Milwaukee electrical contractors' Code Consultant) and B. R. Wisniewski (Milwaukee chief electrical inspector) prior to opening of Western Section, International Association of Electrical Inspectors annual meeting in Milwaukee.

receptacle attached to the left rear third of the mobile home; safe interior wiring and grounding requirements. Development of these standards was accelerated after the state of California enacted legislation last year controlling heating, plumbing and electrical installations in mobile homes and travel trailers, Love noted.

New Officers

At the annual business session, conference delegates voted honorary membership to Harley R. Markel, Cincinnati, Ohio; approved a change in the IAEI Articles of Association that will expedite proposals for code changes; elected a full slate of officers for next year.

New Western Section, IAEI officers are: president—W. E. Stewart, St. Louis, Mo.; 1st vice president—W. P. Hogan, Jr., Chicago, Ill.; 2nd vice president—H. B. Love, Detroit, Mich.; secretary-treasurer—D. M. Lines, Topeka, Kansas.

Elected to the Western Section Executive Committee were: C. B. Tressel, Canton, Ohio; R. B. Thomson, Kansas City, Mo.; E. E. Patterson, Oklahoma City, Okla.; S. M. Sanford, St. Paul, Minn.; L. S. Crain, Lincoln, Neb.; R. S. Davis, Detroit, Mich.; and A. A. Sommer, Chicago, Ill.

Western Section representatives to the International Executive Council, IAEI, are: G. C. Monroe, Springfield, Mo.; A. H. Welklin, Ft. Wayne, Ind.; D. M. Lines, Topeka, Kansas. Alternates are L. S. Crain, Lincoln, Neb.; and W. E. Stewart, St. Louis, Mo.

The 1960 annual meeting of the Western Section will be held in Kansas City, Mo., time and place to be announced later.

Northwestern and Southwestern Sections

Approximately 450 members and guests of the International Association of Electrical Inspectors journeyed to Seattle, Wash., and to Santa Rosa, Calif., during the last week in August and the first week in September to attend two interesting meetings successively held by the Northwestern and Southwestern Sections of that organization. The first meeting, presided over by James A. Paxton, chief inspector of Spokane, registered that section's largest attendance to date with 200, while the second meeting, with Chester Hefner, inspector for San Mateo County, presiding, topped the attendance of its northern neighbor by an additional 50. With the meetings scheduled in sequence, national officers, several key speakers and some of the delegates could attend both gatherings, and for that reason the two meetings are related in this report.

At both meetings, copies of the revised code were accepted with general approval by those present. Also at both meetings, Walter O. Zervas, research engineer for the American Iron and Steel Institute, reviewed the use of conduit for electrical work. While his remarks primarily concerned the use of steel, the case for aluminum was equally well presented by Leon Guibara of Kaiser who employed a novel truck display in his demonstrations. Discussing the use of both metals was Herbert Ufer of Rome Cable who, because of his company's recent alliance with Alcoa, could impartially relate advantages and applications of the two. In this comparison, Ufer noted that, for service masts, steel conduit won a decided nod.



COMPOSING a resolution at annual conference in Milwaukee are electrical inspectors Gordon Maltby, Evanston, Ill., and W. D. Rouch, Louisville, Ky.



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Another topic of interest concerned overload protection for 3-phase motors. James W. Cooke of General Electric announced that Underwriters' Laboratories will soon conduct a survey for the industrial control section of NEMA to determine whether OL protection should be insisted upon for all motor phases.

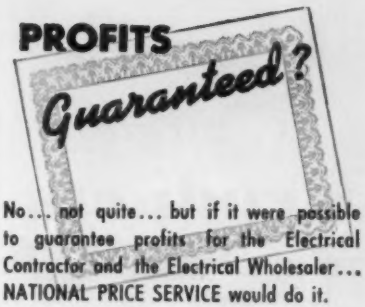
Other speakers addressing both gatherings included chief inspector Rene La Belle of Montreal, Quebec (one of two Canadians who have served as IAEI presidents), and Everett Cogan, the Association's present secretary-treasurer. La Belle urged delegates to re-evaluate their responsibilities to the public and to rededicate themselves to the task of insuring lives and property by conscientiously enforcing the code, while Cogan reported that the international organization had suffered only a minor drop in membership since dues had been increased.

Copies of the revised code were distributed by Frank Stetka, NFPA field engineer, who discussed the new numbering system, important editorial changes, cross-indexing at the rear relating old to new paragraphs, and the use of bold-face type to indicate substantial changes.

Static Current Discussed

At the northern meeting, two additional talks on static electricity were of special interest. Howard Polland, U. S. Bureau of Mines' Health and Safety Engineer, and Kent Stiner, former electrical inspector now employed by BullDog in Detroit described the nature of static electricity, demonstrating its generation, discussing how it can be controlled and safely eliminated, and how this applies to critical areas such as hospital operating rooms. Polland also advocated proper grounding, bonding, use of static detectors and humidification, while Stiner discussed highlights of the Hospital Operating Room Safety Practices, published by NFPA as Bulletin No. 56, adding that, since NEC omits this problem, city and state legislation should adopt the standards and insist that all directives concerning both personnel and maintenance be followed completely and exactly.

Two panel discussions completed the program of the northern meeting, one on higher secondary distribution voltages for commercial installations and the other pertaining to code rulings and interpretations.



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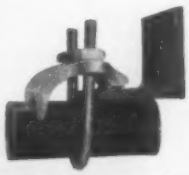
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PROMINENT electrical inspectors supporting Iowa's recently passed licensing enabling act are M. K. Dewey, municipal utility, Cedar Falls, Iowa; and city inspector H. F. Waychus, Mason City, Iowa, who is also chairman of the Iowa Chapter, IAEI.

The first followed a talk on "Fault Current" by Reed of General Electric, in which the speaker related his topic to service equipment and demonstrated several new devices designed to withstand stresses that could be developed.

In the related panel discussion, it was agreed that (1) mixed voltages in the same raceway makes color-coding essential, (2) bonding and grounding in prescribed fashion cannot be overemphasized, (3) use of dry-type transformers has definite advantages in numerous locations, (4) higher distribution voltages have definite economic advantages, and (5) typical distribution voltage levels throughout the northwest include 240/416 and 265/460 as well as 277/480 and 120/208 volts. Those serving on this panel included Walter Gordon, consulting engineer, Tacoma; Lysle Gleason of Seattle; W. A. Gallotte of the Puget Sound Power and Light Co.; and Bert Hardy, Tacoma's chief electrical inspector.

The panel on code interpretations included Beverly Travis, consulting engineer, who presided at this session; H. B. Whitaker of Underwriters' Laboratories in New York; Kent Stiner from BullDog; Chris Klawa, Oregon State; H. H. Watson from General Electric, Bridgeport, Conn.; Edward Tubbs, Bellingham inspector, and Cliff Atkins, also from Oregon State. After a lively question and answer session, two motions for code changes were voted: (1) that dual ratings on caps and receptacles be abolished, a recommendation based on the report that a cap improperly inserted could energize the ground wire and cause serious bodily injury, and (2) that fixtures be marked with temperature limitations when internal wiring is within 3 in. of lamp ballasts.

Joe Gray New NW Head

Elected to head this Section for the coming year was Joe F. Gray, chief inspector for Portland, Ore., with Edward M. Tubbs and Eldon Shirley, Billings, Mont., serving as first- and second-vice presidents respectively. W. L. Gaffney was re-elected as secretary-treasurer.

Serving on the IAEI Executive Council for the up-coming term are Cliff Atkins, Oregon State inspector (candidate); H. S. Morr, Salt Lake City (delegate); W. R. Volheye, chief inspector for Oregon State, and Joe Gray (alternates). Executive Committee members will include L. Christensen, Salt Lake City inspector; Mark Luncy, chief inspector for Idaho; J. D. Gawne from Seattle City Light Co.; J. Hyde Stayner, Utah Power & Light; T. M. Widrig from General Electric Co.; Beverly Travis, Seattle, and James Paxton, Spokane.

At the Southwestern meeting at Santa Rosa, delegates heard all of the 2-meeting speakers mentioned above, plus Thomas N. Saunders, new chief for the California Division of Industrial Safety, who announced that State Safety Orders were now being revised and that inspectors should participate in relating up-to-the-minute rulings to new products, methods and practices.

President Hefner stressed the importance of local chapter activities, welcomed the New Mexico Chapter into the Southwetern Section and proposed that thought be given to holding some future annual conference in that state.

Heart of this meeting was a series of three code workshops, wherein important changes in the new code were discussed by H. B. Whitaker, UL, who recently assumed the duties of NFPA Code Correlating Committee secretary. The workshops, related to residential, commercial and industrial wiring, were respectively presided over by Horace Lee of Oakland, Anthony F. Nastro of Sacramento and L. O. Trim of Burbank, while secretarial chores were handled by Howard Reymers of UL; O. G. Wedekind, likewise from UL; and Charles T. Brooke. In these various workshop sessions, 18 proposals for code changes were recorded. One suggested that a common grounding conductor be made mandatory (Section 250-53) in order to provide a low impedance fault path; another suggested an interim amendment related to the possible breakdown of submersible lighting units in



N. Y. BOARD of Fire Underwriters was well represented among those attending the 35th annual eastern section meeting of IAEI at Spring Lake, N. J., including (L-R): E. Kline, Syracuse, N. Y., Francis Waters, Auburn, N. Y., and L. P. Nordholm, Binghamton, N. Y.

swimming pools, and a third suggested that higher voltages be permitted for lighting equipment installed less than 8-ft above the floor, if properly installed.

During one of these workshops, Carsten Henningson of G. E.'s computer department also explained that, due to sensitivity of some transistor functions in computing machines, it is difficult to comply with code rules pertaining to grounding, and he was requested to submit suggestions to the proper code panel for their consideration.

Nelson Elected SW President

In the election of new officers for the Southwestern Section, Ernest Nelson of San Leandro was named president; Arthur P. Vesco, San Diego inspector, Charles Pierce, Fresno inspector, and Paul Davidson, Phoenix inspector, were named first, second and third vice president, respectively, while Lou La Fehr, Alhambra inspector, was reelected as secretary-treasurer.

Executive Council members for the coming year will include E. E. Carlton, California State, and Arthur Veit, Los Angeles County inspector (reelected), with Chester Hefner and Barney Alverson of San Bernardino serving as alternates. Chester Hefner was also named to serve on the Executive Committee, as were Kearny Byland, Arizona Chapter; George W. Hayden, Central Calif. Chapter; E. Warren Small, Hawaii Chapter; I. J. Sandorf, Nevada Chapter; D. H. Hansen, Northern Calif. Chapter; Lester Wolditt, Sacramento Valley Chapter; E. V. Muller, Southern Calif. Chapter; George A. Kolb, New Mexico Chapter, plus H. K. Winterer, retired, H. G. Ufer, Rome Cable Co., and W. A. Cyr, *Electrical West* consulting editor, as associate committee members.

Robert W. McChesney

Robert W. McChesney, former president of Harry Alexander, Inc., Washington, D. C., died on September 10. He was 68.

Mr. McChesney was elected president of the National Electrical Contractors Association in 1939, and was re-elected for four additional terms. In 1941 he received the James H. McGraw Award Contractors Medal.

Mr. McChesney was born in Washington, D. C., in 1891. He started his electrical career as an apprentice electrician for the Western Electric Company at the age of 13. He worked as a journeyman and then became electrical installations supervisor for the Kluckhun Brothers and the W. G. Cornell Company. He served in those capacities from 1910 to 1916 when he was named manager of the electrical department of the Cornell Company.

In 1919 Mr. McChesney joined the Washington office of Harry Alexander, Inc. For the next ten years he served first as a manager and then vice president in charge of the Washington office. In 1929 he and Cecil M. Munoz acquired the business after the death of Mr. Alexander. In 1945 Mr. McChesney purchased Mr. Munoz' interest in the company and became president, a position he held until his retirement earlier this summer.



ON-THE-JOB-HUDDLE between Square D representative Charlie Croft and Stetson Electric's supervisor M. J. Boyak took place during installation period of Los Angeles Furniture Mart project, when plywood-capped pedestal for local distribution panel was pressed into service to serve as pro-temp drawing board. Short section of square duct seen beneath pedestal plate connects with top of panel on lower floor.

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Florida Contractors Hold Annual Meet

The Florida Association of Electrical Contractors held their seventh annual convention and electrical trade show in Jacksonville October 7-10 in the Robert Meyer Hotel. The four-day affair, which had a total registration of over 425 contractors and guests, carried the theme of "For the Sizzling 60's," and all of the talks, panel discussions and forums were geared to this theme.

The business sessions of this conference were held during the morning hours, and exhibits were open to the contractors and their guests during the afternoon and evening hours. Forty-one firms occupied a total of 55 exhibit booths and displayed a representative cross section of electrical products, electrical contractor tools, etc.

The conference was opened by FAEC Vice President James R. Ward, who introduced Jude Joseph, President, Jacksonville (host) Chapter of FAEC, to welcome the group. President Joseph's opening remarks were followed by an address of welcome by Hon. Haydon Burns, Mayor of Jacksonville since 1949. Mayor Burns very aptly set the pace for following talks devoted to electrical growth in Florida, by describing and enumerating municipal and civic improvements, urban renewal and building construction work under way in Jacksonville, which is at an all-time record.

Mayor Burns' address was followed by an official convention opening address by FAEC President C. Wesley Olson, Jr. President Olson urged members and guests to attend each conference session and to visit all of the exhibits. He also reviewed briefly the aims and objectives of the Association and activities carried on during the past year.

Unification Urged

A three-man panel, moderated by Past-President Howard L. Palmer, discussed "It's High Time to Unify to Electrify . . . for the Sizzling 60's." Mr. Palmer pointed out that a recent study indicated that 41,250 Florida families depend principally on the electrical industry for their livelihood. The panelists were: J. Henry Keele, vice president Florida Power & Light Co.; William B. Shenk, vice president Florida Power Corp.; and Gilbert D. Leach, Tampa Electric Co. Questions turned in previously and those presented by the audience were effectively answered by the panelists.



NEW PRESIDENT of the Florida Association of Electrical Contractors is A. R. Williers (right), Williers Electric Co., Tampa, who was inducted into office on October 10 during the FAEC annual convention in Jacksonville. Former (1959) President C. Wesley Olson, Jr., congratulates Dick on his election and assures him full cooperation of the Association's officers and members.

Considerable discussion centered on nationally sponsored programs, such as: Housepower, Live Better Electrically, Total Electrical Living, and Medallion Homes. Not only were the programs and their objectives defined, but also the profit possibilities for the contractors were explored and pointed out. It was clearly indicated by the discussions that it is necessary to "unify to electrify" if these profits are to accrue to all segments of the industry.

Four FAEC members staged a 2-act skit titled "If I Were a Jobber's Salesman in the Sizzling 60's I'd. . . ." In Act I, the dislikes in salesmen, as seen by electrical contractors, were aptly portrayed. These included high pressure, ignorance, sell more than needed, waste time, begging attitude, no follow through, too curious about private affairs, in a hurry, negative approach. In Act II, the essentials of a good salesman were portrayed, and included good and sincere handshake, good posture, right tone of voice, careful enunciation, physical and mental alertness, self confidence, thorough preparation, desire to be of service. Members who acted out these skits were C. Wesley Olson, Jr., Wallace Omberg, Robert Childers and R. R. Palmer.

A timely address on "The Electrical Contractor and the Architect Look at Each Other" was presented by John Stetson, president, Florida Association of Architects, AIA. Mr. Stetson outlined many of the

problems which are currently faced by both architects and contractors, took a hard but optimistic look at the future and what is happening in the building and construction industry, and offered suggestions for improving relations between architects and electrical contractors. There are two types of architects, he pointed out, and both are facing increasing problems. One is the large architectural firm, the other the small firm, which is the type practicing in Florida. The small firms are faced with competitive "plan" services and lower fees, resulting in poorer service. Another problem is the increasing complexity of work—new devices, new techniques, new methods—for both architects and electrical contractors, he said.

New technology, with special emphasis on labor-saving methods and techniques, is entering the construction industry, Mr. Stetson stated. He urged the contractors to make greater efforts at reducing labor and costs, or the work might go elsewhere. He substantiated this by pointing out research and progress in the field of prefabrication and elsewhere in which electrical work was being incorporated at lower rates.

Estimating and Pricing

A highlight of the conference was an Estimating and Pricing Workshop, conducted by a 3-man panel of estimating experts. This panel consisted of Carl W. Evans, editor, *Electrical South*, who served as moderator; Ralph E. Johnson, president, Sturgeon Electric Co., Denver, author of "Electrical Construction Cost Manual," who also developed the "Estimatic" method of estimating; and John H. Dalton, president, Henderson-Hazel Corporation, producers of National Price Service.

Moderator Evans introduced the subject by outlining the problems in estimating and pricing an electrical job and the methods now in use. He gave a step-by-step procedure for organizing the work and proceeding through the job to final selling price. Each step was then discussed at length, including methods to use and what to do at each step. The usual procedure of estimating formed the basis for these discussions, which were then contrasted with the "Estimatic" procedure by panelist Ralph Johnson.

This workshop developed so much interest that the members asked that it be continued further, and time was set aside for further discussions on two succeeding afternoons following the scheduled sessions of the program. The two extra sessions were devoted primarily to discussion of the Estimatic procedure and service and were handled by Mr. Johnson.

Lucian Harris, III, vice president of the First National Bank of Orlando, addressed the group on "Job Financing." Mr. Harris told the contractors that Florida rates third in the nation in the growth of new businesses, but the State is also tenth in the nation in business failures. He reviewed some of the reasons for this condition. Bankers cannot afford to loan money for capital expenditures without adequate security, he said, and he applied the same yardstick of security to job financing. He urged the contractors to use modern and adequate accounting procedures, and to give their bankers all the facts, in making applications for business loans of all types.

Labor Relations

Another highlight of the conference was a "Labor-Management Relations Forum," with Granville Alley, Jr., labor law attorney, as panel guest speaker. Panelists were: FAEC President C. Wesley Olson, Jr., and FAEC Past-Presidents James Dandelake, Howard L. Palmer, Jr., Vincent Burkehart, Axel Ornberg, and R. H. Palmer, Jr. Mr. Alley discussed the recently-passed Kennedy-Griffith-Landrum amendment to the Taft-Hartley Act and its possible effect on the electrical contracting industry. The new amendment should help the construction industry generally, he concluded, after pointing out many of the provisions which have been included in this amendment.

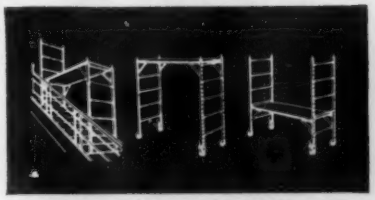
"Profitable Cooperation" was the title of a slide-illustrated talk on electrical modernization in industrial and commercial establishments presented by J. P. Young, manager, Agency and Construction Section, Westinghouse Electric Corp.

Forum on Lighting

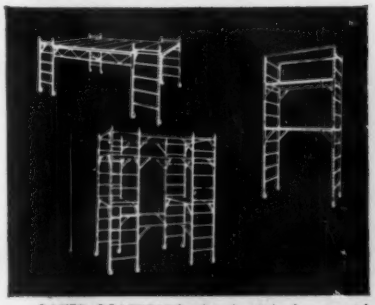
A lighting forum with three guest speakers was moderated by James R. Ward, FAEC vice president. Speakers were Berlon C. Cooper, associate editor, *Electrical Construction and Maintenance*, who spoke on "Lighting Trends"; Hugh Saussy, Progress Manufacturing Co., who discussed "Laying Out Your Lighting Jobs"; and Claude Rollick, Thomas Industries Inc., who discussed "Up-Lighting Indus-

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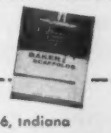


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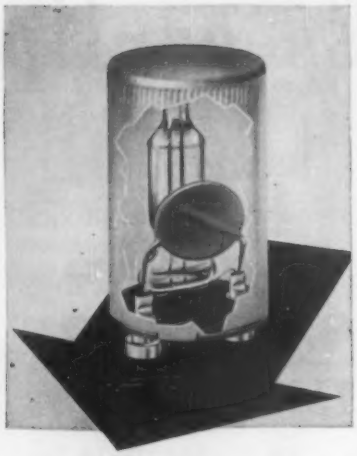


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OFFICERS of the Florida Association of Electrical Contractors in attendance at the FAEC annual convention in Jacksonville early in October included (l to r): E. H. Wallis, Jr., president, Florida West Coast Electrical Contractors Association, St. Petersburg; and Robert Knoles, State director, FAEC, and vice president of the Edison Electrical Contractors Association, Fort Myers.

try" and presented a 14-minute moving picture film which showed outstanding home lighting practice in Medallion Homes in Florida. A question-and-answer period followed these presentations on lighting.

An all-industry banquet was held on the second night of the conference, at which an encouraging picture of the future for the small businessman was presented by guest speaker Ed Wimmer, vice president of the National Foundation of Independent Business.

The convention closed with the usual social function—a banquet and dance. Guest speaker for this occasion was Dr. Frank Goodwin, professor of marketing, College of Business Administration, University of Florida, whose unmatchable wit and humor provided a suitable climax for a highly successful convention, as well as an appropriate medium for an inspirational and profitable message on how to meet the challenge of a dynamic future.

Officers for 1960

Installation of the newly elected officers followed the banquet session. These officers are: president—A. R. Williers, Williers Electric Co., Tampa; 1st vice president—James R. Ward, Ward Electric, Inc., Bradenton; 2nd vice president—Paul Foster, Foster Electric Co., Inc., Miami; secretary-treasurer—Wallace Omberg, Curry Electric Co., Orlando; and recording secretary—Curtis Lee Futch, Brevard Electric Co., Titusville, Fla.

NISA News

A Texas-size crowd—175—was on hand for the fall meeting of the Southwestern Chapter of NISA in Houston, September 17-19.

In addition to the chapter's members from Texas, Oklahoma, New Mexico and Arizona, guests from Iowa, New York, Florida, New Jersey, Indiana, and Illinois were present. So was NISA's president, Horace C. Blenkhorn, of St. Catharines, Ont., Canada.

Bruce H. Shaffer, service engineer of Allis-Chalmers' Norwood, Ohio, electrical department, spoke on maintenance controls; Ray Reading, chief magnet wire engineer, Belden Manufacturing Co., Chicago, discussed new developments in insulation; and H. B. Black, vice president and trust officer of Houston's First City National Bank, described retirement plans.

"Building Metals Molds for Epoxy Encapsulations" was the topic of a talk by James A. Phares, Southwest Electric Co., Oklahoma City, Okla.

George T. Kinard, of Beaumont, Texas, was elected president to assume his duties in March, 1960. Other new officers are: James A. Phares, first vice president; James A. Morgan, of Fort Worth, Texas, second vice president; and Connie H. Henry, of Dallas, secretary-treasurer.

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The next meeting of the Southwestern Chapter will be held in Dallas, Texas, at the Baker Hotel, March 10-12, 1960.

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NISA meetings seem to be getting bigger and bigger. In Cedar Rapids, Iowa, 46 members, a big crowd for that part of the country, were on hand for the fall meeting of Midwestern Chapter. Shop owners from Iowa, Nebraska and Minnesota heard Harry E. Smith and Karl F. Lathrop of General Electric discuss the company's new "8000" series motors and silicone rubber insulation systems; H. Craig Knop and Richard P. Pooler, The Travelers Insurance Co., describe the operation of rating bureaus and ways to reduce insurance costs by eliminating shop hazards; Leo Kowal, Metals & Controls Co., talk on methods of determining sizes, base types, terminals, etc. of motor controls; and Arthur C. Roe, the NISA engineer, speak on "Wire Plus — Insulation Minus — Equals Low Cost."

Estate planning was discussed by F. S. Ruhl, trust officer, Merchant's

National Bank, Cedar Rapids, Iowa; and Scotty Lyall, Insulation & Wires, Inc., put on a demonstration of epoxy winding at a local shop, Electric Motors Co.

• • • •

Another record crowd, 130, attended the Pacific Northwest Conference, an international regional meeting of NISA's British Columbia, Puget Sound, Inland Empire and Oregon chapters. It was held in Seattle's Doric New Washington Hotel, October 2-3. Speakers included Claude Brown, assistant vice president, National Bank of Commerce, Seattle, who discussed sales and collection problems; Ronald Clark, Phelps Dodge Corp., whose topic was magnet wire insulation; and Richard Parker and Fred Stearns, Metals & Controls Co., who answered questions about relays.

NISA president Horace C. Blenkhorn, was also on hand.

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The open-type motor in applications formerly requiring expensive enclosures was discussed at a meeting of Chicago Chapter, October 13.

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A movie on Class H systems was shown to members of Connecticut Chapter by Mike Nakonechny, Dow Corning Corp, at the group's October meeting at Waverly Inn, Cheshire, Conn.

• • • •

Michiganders got together on October 19 at a joint meeting in Lansing of the Great Lakes and Western Michigan chapters. D. L. Benhard, of International Research & Development Corp., was the principal speaker, his topic being vibration analysis. NISA president H. C. Blenkhorn and executive vice-president Joseph M. Harrington were present.

• • • •

Bruce Shaffer of Allis-Chalmers gave his talk on maintenance control before members of King Coal Chapter at the organization's quarterly meeting on October 8 in Marion, Ill. Giles Armature & Electric Works was host.

• • • •

Members of NISA's Western Michigan Chapter were treated to an after-dinner epoxy encapsulation demonstration by D. W. Looman of Sterling Varnish Co. Stan Stutsman, of Stutsman Electric Co., furnished the tools, shop and a 15-hp motor. The meeting was held in Harbor Springs, Mich., September 11.

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Another big crowd, even for the New York Chapter, heard Frank MacPherson of Electron, Inc., discuss the use of industrial electronic tubes in control circuits. There were 65 at the meeting, held on September 17 at Hotel Shelburne.

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Perhaps one of the reasons NISA chapters' attendance is improving is the central speakers bureau at association headquarters, 7730 Carondelet Avenue, St. Louis 5, Mo. Manufacturers, suppliers and others who would like to get on the NISA circuit should write to Joseph M. Harrington, executive secretary, giving the names of speakers, their subjects and details of any visual aids that would be used.

NISA then passes this information along to chapters who select the programs of greatest interest, clearing names and dates with headquarters.

• • • •

Baseball (TV variety), golf, swimming and cards occupied most of the time of 100 members of NISA's New England, Ontario, Quebec, New York and Niagara chapters at the annual outing at Adirondack Inn, Sacandaga Park, N. Y. September 11-12.

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A topic of growing interest, the servicing of submersible pumps, was discussed by Jack Weyler, service supervisor, Franklin Electric Corp., Buffton, Ind., at Quaker City Chapter's October 14 meeting at Beck's-on-the-Boulevard restaurant.

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A tour of Certified Service Co., Dayton, Ohio, which rebuilds hermetically sealed compressors, was made by members of Miami Valley Chapter on September 21.

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A record attendance for Mid-South Chapter, 78, were on hand in Knoxville, Tennessee, on September 11-12 to hear John Swartzbaugh, president of Tennessee Businessmen's Association; Ray Dollar, Warner Electric Brake & Clutch Co.; and J. Arthur Turner Jr., the NISA vice president, of Tampa, Fla.

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Nearly 100, another record, were at Joplin, Mo., at Hotel Connor October 9-10, to hear NISA president Horace C. Blenkhorn; NISA executive vice-president Joseph M. Harrington; NISA engineer Arthur C. Roe; and Horace B. Barks, of Horace Barks Publications, St. Louis, Missouri. Arrangements for the meeting had been made by Bill Pickett, Electric Motor Supply Co., Joplin, the newly elected president of Heart of America Chapter.



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CHAIRMAN of the National Technical Conference Committee, Charles L. Amick of St. Louis, Mo., presided at both opening and closing sessions of the Illuminating Engineering Society when that organization convened in September for its 1959 Technical Conference.

DATES AHEAD

International Association of Electrical Inspectors—George Welman Chapter, New Orleans, La., November 24; Kentucky Chapter, Kentucky Hotel, Louisville, Ky., January 21-22, 1960; Virginia Chapter, Mariner Hotel, North Virginia Beach, Va., April 4-5

National Electrical Contractors Association—Annual convention and 5th National Electrical Exposition, Fontainbleau, Eden Roc, Deauville and Carillon Hotels, Miami Beach, Fla., November 9-12.

National Electrical Manufacturers Assn.—Annual meeting, Traymore Hotel, Atlantic City, N. J., November 9-13.

Industrial Electric Exposition—Sponsored by Electrical League of Western Pennsylvania, Penn-Sheraton Hotel, Pittsburgh, Pa., November 17-19.

American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 31-February 5, 1960.

16th Annual National Wiring Sales Conference—Warwick Hotel, Philadelphia, Pa., February 25-26.

5th National Electrical Industries Show—New York Coliseum, New York, N. Y., March 6-9.

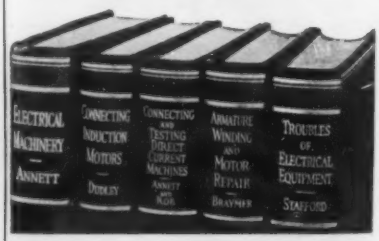
National Association of Electrical Distributors—Annual convention. Dallas, Texas, May 1-5.

National Industrial Service Assn., Inc.—Annual convention, Hotel Fontainbleau, Miami Beach, Fla., May 4-7.

National Fire Protection Assn.—Annual meeting, Montreal, Canada, May 16-20.

Illuminating Engineering Society—National Technical Conference, Penn-Sheraton Hotel, Pittsburgh, Pa., September 11-16.

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GROUNDING AND THE NE CODE

[FROM PAGE 129]

of its proper observance in the field to provide effective grounding. The most common errors found and which are definitely violations of Sec. 250-51 concern the method of handling the neutral where the neutral is not used for obtaining line to neutral voltage.

A simple rule can cover the foregoing problem: where a power system utilizes only the voltage between phases and is supplied from a grounded system the neutral or grounded conductor shall be run to the service disconnect means; and, within the service equipment, it shall be bonded to the equipment ground. From that common point, a common grounding conductor for the service and the equipment ground shall be run to the grounding electrode. Such a neutral when not used to obtain line to neutral voltage shall have a capacity equal to 25% of the capacity of the main service conductors. An inspection of Figs. 3 and 4 will disclose why that is necessary if we are to comply with Sec. 250-51 and clear a fault of any magnitude.

In the case of Fig. 3, which is incorrect, we find that one side of the fault circuit, the phase conductor A, runs within the service conduit while the other conductor of the fault circuit not only runs outside of the conduit enclosing conductor A, it has also in the circuit both the transformer grounding electrode and the service grounding electrode in series. The result will be too high an impedance of the fault circuit to operate any but one of the smallest overcurrent devices in the circuit.

If on the other hand, the correct connections are made as shown in Fig. 4 we find that both conductors of the fault circuit are within the same conduit. The result will be that the fault circuit will have an impedance sufficiently low to operate the overcurrent devices in the circuit. For simplicity in Figs. 3 and 4, the phase lines B and C have been omitted.

A system in common use is a delta bank providing both 3-phase service and a 3-wire lighting service. Here again, exactly the same condition applies. The neutral must be run to the power service disconnect means or we make it impossible to clear a fault on the power system under certain conditions. Figs. 5 and 6 illustrate this. If we trace the fault circuit in the case of Fig. 5 we have a high-impedance fault circuit the same as in Fig. 3.

A study of Fig. 6 will show that when a fault occurs in either the power system or the lighting system there are three parallel paths of fault current flow. However, two of the fault current paths are of such high impedance that they have no material effect on the overall impedance. In case of the power system as shown in Fig. 6, the low-impedance path is shown in heavy solid lines. A second parallel fault current path would be over the common grounding conductor through the grounding electrode G2 through the earth to the transformer grounding electrode G1 and then to the transformer neutral. The third parallel fault current path would be through the common grounding conductor over to the neutral in the lighting service and back to the transformer.



ELECTED TO GUIDE IAEL policies for the coming year are C. C. Simpson, managing director of the Chicago Electric Assn, incoming president; Robert J. Harrison, new treasurer, representing the Nebraska-Iowa Electrical Council; William M. Freudigman, vice president Electric League of Rhode Island, and Robert O. Trottier, secretary, managing director of the Intermountain Electrical Assn in Salt Lake City, Utah.



NEWLY ELECTED to IAEL's Board of Governors are Ralph Hubbard from Denver, Albert Maillard from Indianapolis, Glen Logan of Los Angeles, Harry Foy of Toronto, Ont., Canada, and John Morrison of Philadelphia.

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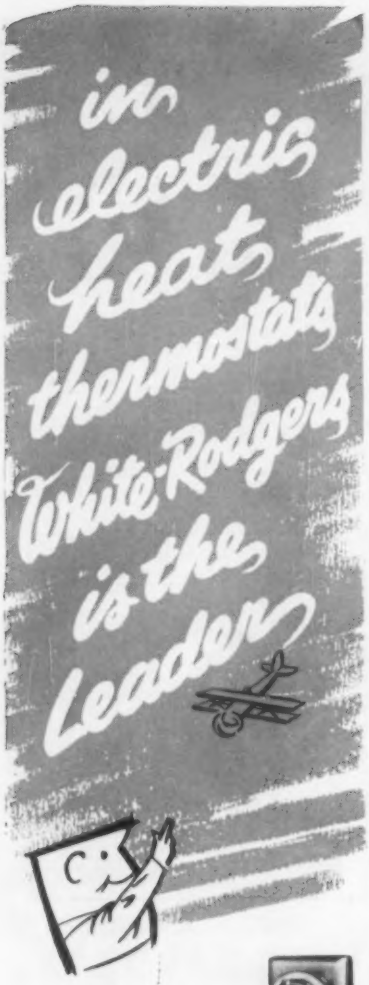
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Among the Manufacturers

Headquarters Announcements

Peerless Electric Co., Warren, Ohio, is now the **Peerless Electric Div. of H. K. Porter Co., Inc.**, Pittsburgh, Pa.

Electric Autolite Co. is new name of **Electric Auto-Lite Co.**, which has just purchased **C & D Batteries, Inc.**, Conshohocken, Pa.

Okonite Co., Passaic, N. J., has assumed responsibility for the sales of **Kennecott Wire and Cable Division's** products.

Southern Electrical Co., Chattanooga, Tenn.—William J. Hegan III, director of electrical conductor sales.

Federal Pacific Electric Co., Chicago, Ill.—Clifford E. Harris, division manager; John S. Messer, executive consultant; John W. Muse, division marketing manager.

Sola Electric Co., Chicago, Ill.—John B. O'Donnell, distributor sales manager.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—New senior vice presidents: Boyd S. Oberlink and J. L. Singleton; new vice presidents: Roy M. Casper and L. W. Davis.

Advance Transformer Co., Chicago, Ill.—Richard A. Daunoras, treasurer.

International Resistance Co., Philadelphia, Pa.—Walter Ware Slocum, president.

Emerson Electric Mfg. Co., St. Louis, Mo.—New advisory members of the board of directors: Edward L. O'Neill, William L. Davis, Jr., and Charles G. Gulledge.

Cutler-Hammer Inc., Milwaukee, Wis.—E. S. Mathiesen, vice president in charge of manufacturing.

Harvey Hubbell, Inc., Bridgeport, Conn.—Wayne Brassey, field sales manager.

Pittsburgh Standard Conduit Co. Verona, Pa.—New directors: J. Taylor Foster and William F. Lecraw.

Kaiser Aluminum & Chemical Corp., Oakland, Calif.—Gillette N. Houck, assistant to the manager, Electrical Conductor Div.

John C. Virden Co., Cleveland, Ohio—Frank J. Gubernot, vice president, finance.

Toledo Pipe Threading Machine Co., Toledo, Ohio—Robert S. Bollin, chief engineer.

3E Company, Melrose Park, Ill.—Paul H. Coleman, director of manufacturing; Robert E. Deal, manager of marketing.

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Triangle Conduit & Cable Co., Inc., Brunswick, N. J.—New directors: J. E. McAuliffe, Jr., and J. M. Slater.

Compco Corp., Chicago, Ill.—Dan E. Dunne, manager, Mitchell Lighting Div.

Whitney Blake Co., New Haven, Conn.—Robert H. Beisswenger, vice president and sales manager.

United States Motors Corp., Oshkosh, Wis.—Robert L. Schultz, sales manager—distribution.

McGill Mfg. Co., Inc., Valparaiso, Ind.—James C. McGill, assistant general manager; James S. Eason, general sales manager; Howard Powell, plant manager; Gunnard Nielsen, chief product engineer.

Aluminum Co. of America, Pittsburgh, Pa.—New officers, **Rome Cable Div.:** Robert L. Williamson, vice president and general sales manager; Frederick S. Marks, Sr., vice president and manager of distribution; Gerard A. Weiss, treasurer.

Westinghouse Electric Corp., Pittsburgh, Pa. — New appointments, **Sturtevant Div.:** James W. Wilcock, manager; H. W. Rainey, Jr., general sales manager.

Christie Electric Corp., Los Angeles, Calif. — Fred Benjamin, sales manager.

Regional Appointments

NEW ENGLAND

International Rectifier Corp.: Angus Scott, manager, New England area office.

MIDDLE ATLANTIC

Pass & Seymour, Inc.: Donald Guy, representative in western New York.

Leeds & Northrup Co.: Manley S. Nolen, Pittsburgh district manager.

SOUTH ATLANTIC

Progress Mfg. Co., Inc.: Frank Cody, representative in Georgia, Alabama, eastern Tennessee, and Pensacola, Fla.

EAST CENTRAL

Pass & Seymour, Inc.: Joseph Discenza, Chicago district manager.

Leeds & Northrup Co.: Willard H. Neu, Chicago district manager.

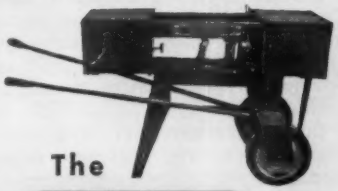
Day-Brite Lighting, Inc.: Raymond P. Imre, manager of sales, midwestern region.

Pittsburgh Standard Conduit Co.: Koray-Crossey Co., sales representative in Chicago area.

Thomas & Betts Co.: John J. Klein, district manager, Cincinnati.

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Federal Pacific Electric Co.: John N. Hutson, district manager of new sales office in Birmingham, Ala.

Electro Lighting Corp.: A. Lee Clifford and Co., representative in Indiana, part of Kentucky, and part of Tennessee; Donald Springer, representative in southeastern Ohio.

Cutler-Hammer, Inc.: E. C. Bolton, midwestern regional sales manager.

William Brand & Co., Inc.: E. S. Needler, sales agent for Indiana.

Allis-Chalmers Mfg. Co.: T. L. Dineen, manager, general industrial sales, Cleveland district.

WEST CENTRAL

Progress Mfg. Co., Inc.: Jack Akin, representative in Kansas, Nebraska, and parts of Iowa and Missouri; Leonard Schwartz, representative in Texas; Sam Humphrey, representative in Oklahoma and East Texas; Ed Hoffman, representative in Wisconsin.

Youngstown Sheet and Tube Co.: Maurice P. Rees, district sales manager, Milwaukee district.

Pass & Seymour, Inc.: Melvin Wright, representative in Oklahoma, northern Texas and Arkansas.

Clayton Mark & Co.: R. L. Brewer Co., Inc., representative in El Paso County, Tex., and New Mexico for Conduit Div.

Standard Transformer Co.: F. C. Clatterbaugh and C. R. White, representatives in Iowa and Nebraska.

Fullman Mfg. Co.: New representatives: V. E. Stephens, Dallas, Tex.; Arthur H. Swartz, Houston, Tex.; Harvey M. Olmstead, New Mexico, in addition to present Denver, Colo., territory.

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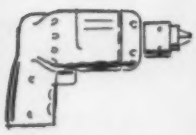
Pass & Seymour, Inc.: William H. H. Reeder, West Coast district manager; Stanley D. Whitford, western marketing manager.

Thomas Industries Inc.: Baxter Sharp, Jr., representative for Moe Light Div. in San Francisco area.

Read Standard: Robert M. Langmack Co., representative handling aluminum lighting standards on West Coast.

G. H. Leland, Inc.: Hyde Electronics Co., representative in Rocky Mountain area.

Lighting Dynamics: John Sankewich, sales manager, western division; Dave Parker, regional sales manager, northern sales operation, San Francisco.



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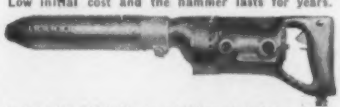
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These standard assemblies can be joined together and the operating mechanisms can be interlocked to perform many different functions. For example, it is quite common to connect two or more assemblies through one or more conduit couplings as shown in Fig. 4. The operating mechanisms are mechanically or key interlocked so the cutouts on only one assembly can be switched to the closed position at one time, thereby connecting the load to only one of two possible sources of supply.

In some areas, it is desirable to have a portable device to provide fuse protection, the combination of fuse protection and switching, or just switching so it can be located close to a load which is movable within a given large area. Portable metal-enclosed assemblies having heavy metal skids welded to the bottom have been used for such applications. On installations of this kind, loop feeders have been used around the circumference of the area with metal enclosed assemblies placed at desired locations. These metal-enclosed assemblies have cable couplers which permit the easy coupling of flexible high voltage cable to the permanent terminal of the coupler on the assembly. The coupling for the assembly in the feeder is key interlocked so the cutout cannot be switched to the "on" position without the coupling having been completed to both the terminals on that metal-enclosed assembly and on the portable metal-assembly at the load point.

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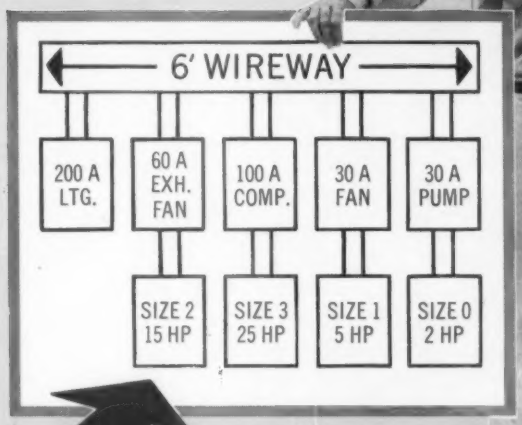
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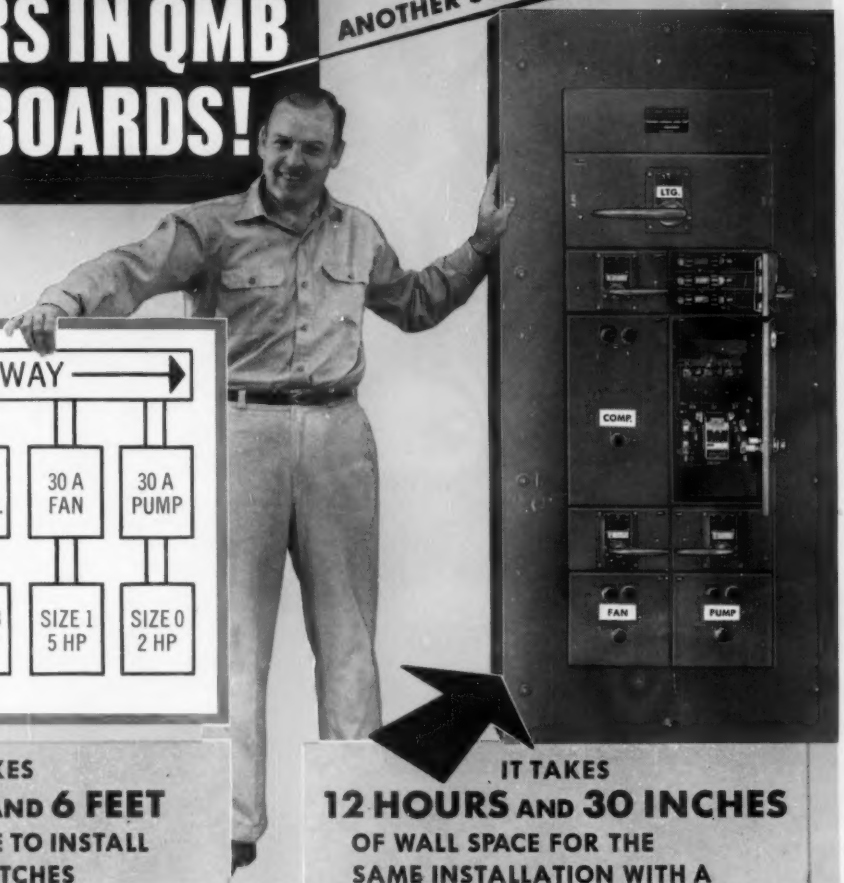
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• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE ISSUE

STARTERS IN QMB PANELBOARDS!

ANOTHER SQUARE D FIRST!

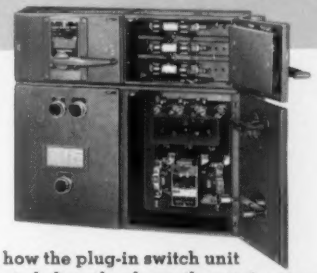




IT TAKES
41 HOURS AND 6 FEET
OF WALL SPACE TO INSTALL AND WIRE SWITCHES AND STARTERS LIKE THIS

IT TAKES
12 HOURS AND 30 INCHES
OF WALL SPACE FOR THE SAME INSTALLATION WITH A QMB STARTER PANELBOARD

Why mount separate starters and disconnect switches? It costs extra money. It wastes space. It takes a lot more time. QMB Starter Panelboards give you a *safer* installation because you can't open a starter when the switch is ON. They give you a much *better looking* job. Since they can even be *flush* mounted, they offer a lot more installation *flexibility*. QMB panelboards accommodate reversing and non-reversing starters, sizes 0 through 3. QMB switchboards and unit substations handle sizes 0 through 5. All of them are available, factory-assembled and wired. Or get enclosures, starters and plug-in switch units from your Square D distributor for on-the-job assembly.



Notice how the plug-in switch unit is mounted directly above the starter, permitting interlocking. The starter cannot be opened when the switch is in the "ON" position.

It's easy to order these starter and switch units. See Page 57 in your Square D Digest and order from your distributor.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

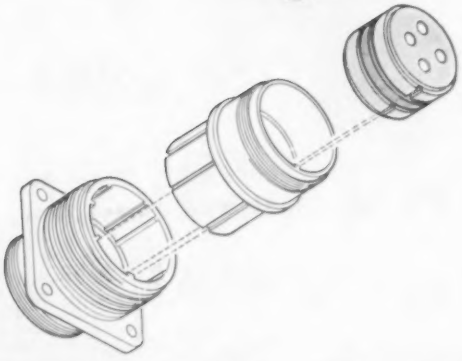
SQUARE D COMPANY

NEW... by CROUSE/HINDS

ARK-trol®

ELECTRICAL CONNECTORS





• Foolproof polarization • Errorless assembly • Maximum interchangeability • Environmental: Exceed rigid military and industrial requirements for resistance to corrosion, chemicals, high and low temperatures, pressure, shock, vibration, dust, humidity, moisture, and leakage of air.

POSITIVE POLARIZATION

Completely foolproof: plug can be mated only with proper receptacle, and in only one way . . . the *right* way. Unsymmetrical contact arrangements preclude improper mating of contacts, or mating of unmatched contact configurations.

FAST, EASY, ERROR-FREE ASSEMBLY

Polarization keyways and unsymmetrical contact arrangement in insert assemblies make improper assembly of parts impossible. One-piece 'snap-in' connectors. Soldering is done outside . . . *before* insertion of contacts.

SEALED AGAINST ENVIRONMENTAL FACTORS

'Stack' assembly includes silicone rubber wafer for impenetrable seal against water, vapors, dust, gas. Basic shells, other metal parts are high-strength extrusions of aluminum alloy, anodized for corrosion, abrasion resistance: 1800 volts are required to penetrate this coating.

MAXIMUM INTERCHANGEABILITY

Components in each diameter are interchangeable and reversible, doubling scope of equipment. Male *and* female shells take either pin or socket inserts: both plug and receptacle may be used 'hot' or 'dead'. Pin and socket configurations available in wide range . . . specials supplied on request.

SHELL SIZES and ELECTRICAL RATINGS



Four shell sizes: from 1-1/16" to 2-9/16" diam. *Voltages:* Military Service Ratings: A, D, E, B, C and Instrument. NEC Rating: 600V. A.C. *Contact sizes:* #16 to #4/0 inclusive. Write for Bulletin 2711 containing complete descriptions, specifications and configuration patterns for both Type RPE and RPC *ARK-trol* Electrical Connectors.

Available in two types:

TYPE RPE ENVIRONMENTAL
- Moisture Proof
- Shock Insulated
- Dust-Tight
- Corrosion Resistant
- Grounded & Non-Grounded

TYPE RPC CIRCUIT BREAKING
- All Features of RPE *Plus* . . .
- Circuit Breaking under full Rated Load

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